JOURNAL

OF THE

FRANKLIN INSTITUTE

OF THE

State of Pennsylvania,

DEVOTED TO THE

MECHANIC ARTS, MANUFACTURES, GENERAL SCIENCE,

AND THE RECORDING OF

AMERICAN AND OTHER PATENTED INVENTIONS.

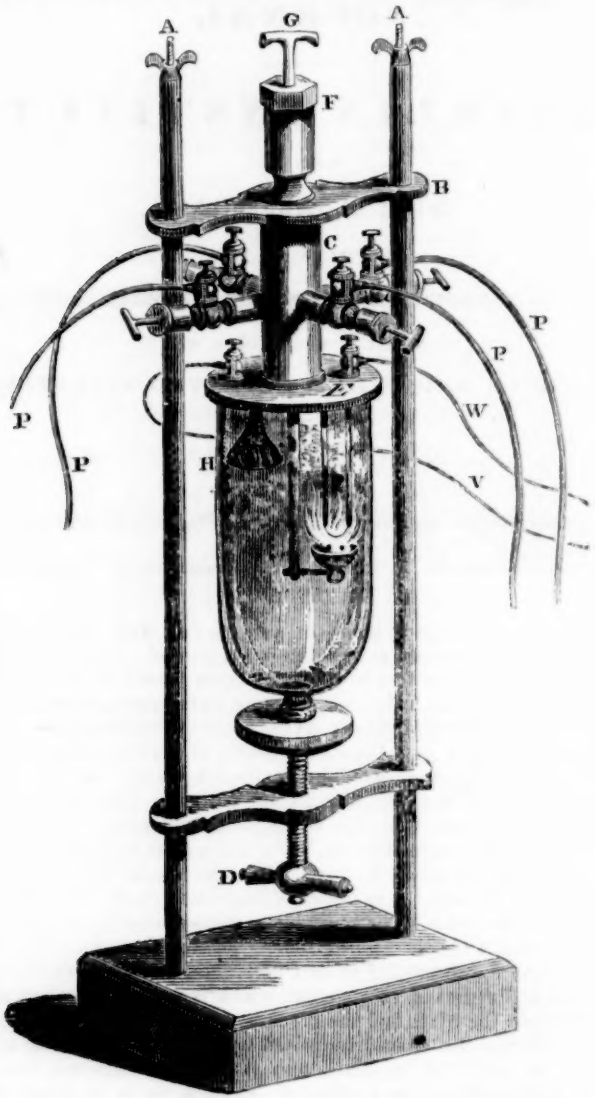
MAY, 1833.

Apparatus for evolving Silicon from Fluo-silicic Acid Gas.

By Robert Hare, M. D. Professor of Chemistry in the University of Pennsylvania.

Into a stout mahogany block as a basis, two iron rods A, A, are so planted as to extend perpendicularly, and of course parallel to each other, about two feet in height. Upon these rods two iron bars are supported horizontally, one, B, near their upper extremities, the other at the height of about six inches from the wooden basis. In the centre of the lower bar, there is a screw, D, having a handle below the bar, and supporting above it a circular wooden block. Into a hole in the upper iron bar, equidistant from the rods, is inserted a hollow brass cylinder C, which at the lower end screws into an aperture in a circular plate of brass, E, which is thus supported horizontally a few inches below the bar. By these means room is allowed for the insertion into the cylinder of four valve cocks, each furnished with a gallows screw. The cylinder is surmounted by a stuffing box, through which a copper sliding rod, G, passes air tight. The brass plate is turned and ground to fit a bell glass of about five inches in diameter, and eight inches in height, which is pressed up when necessary between the plate and the block by the screw D, supporting the block. Within the space comprised by the bell glass, and on one side of the centre of the plate, two stout brass wires are inserted, one of them insulated by a collar of leathers, so as to admit of the ignition, by a galvanic discharge, of a small arch of platina wire, which terminates them. The sliding rod above-mentioned as occupying

the stuffing box, terminates below the plate in an elbow which supports a cap at right angles to the rod, at the same distance from the



rod as the platina wire; and on the opposite side of it, there is a brass cover, H, for the cap, supported from the plate. The arrange-

ment is such that by a suitable movement in the sliding rod, made by grasping it by the handle G, in which it terminates externally, the cup may be made either to receive into its cavity the platina wire, or be made to adjust itself to its cover H.

The bell being removed, about sixty grains of potassium, in pieces not containing more than fifteen grains each, are to be introduced into the cup, which is then to be adjusted to the cover, and the bell secured. In the next place, by means of the flexible lead tubes, P, P, P, P, and the gallows screws attached to the valve cocks, establish a communication severally with an air pump, a self-regulating reservoir of hydrogen, a barometer gauge, and a jar over the mercurial cistern containing fluo-silicic acid gas. First by means of the air pump exhaust the bell, and in order to wash out all remains of atmospheric air, admit hydrogen from the reservoir. Again exhaust and again admit hydrogen. Lastly exhaust the bell of hydrogen and admit the fluo-silicic acid gas. By means of the gauge, the exhaustion is indicated and measured, and by the same means it will be seen when the pressure of the gas within the bell approaches that of the atmosphere. When this takes place, the cocks being all closed, by means of a calorimotor, the platina wire is to be ignited, and the potassium brought into contact with it.

A peculiar deep red combustion ensues, evolving copiously chocolate coloured fumes, which condensing into flocks of the same hue, subside throughout the receiver, like a snow in miniature, excepting the colour. On removing the bell after the potassium is consumed, the cup which held it, will be found to contain silicon mixed with the fluoride of potassium, and with this indeed the whole of the powder deposited is contaminated. Siliciuret of potassium is likewise formed in the cup, since on the affusion of water, a fetid evolution of siliciuretted hydrogen ensues. By washing, the silicon, being insoluble, is left in the state of a chocolate coloured powder.

According to Berzelius' directions, I have washed the silicon first with cold, and afterwards with boiling water, in order to purify it.

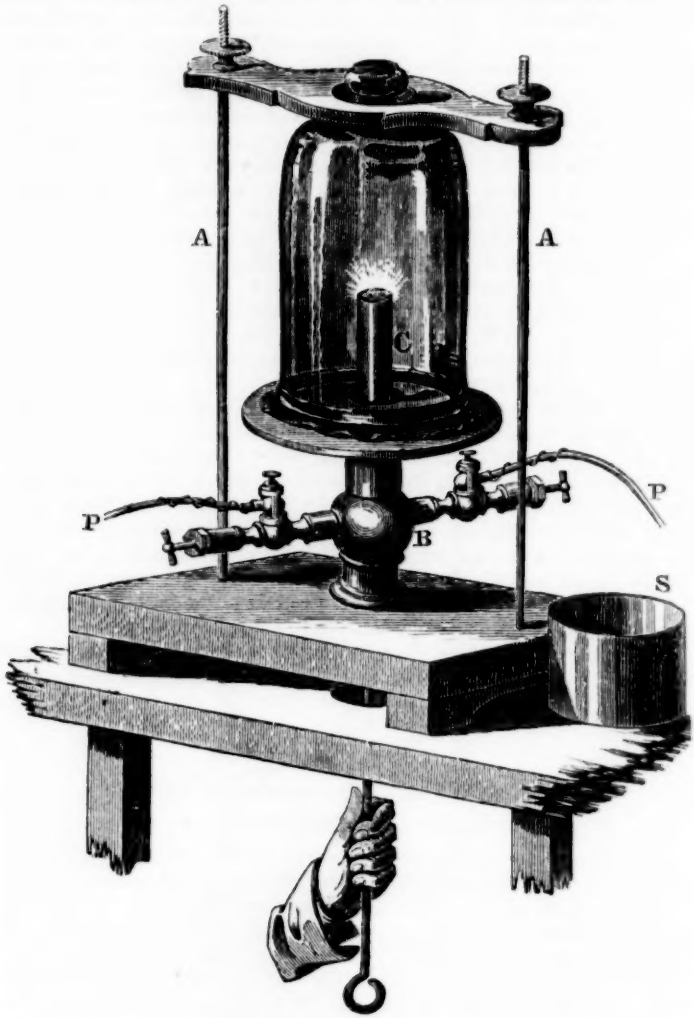
Improved process for the evolution of Boron.

By the author of the preceding article.

By means of an apparatus represented in the annexed engraving, I have succeeded in evolving boron by the reaction of potassium with vitrified boracic acid, in vacuo, without encountering the evil of any explosive action, to which the process, as heretofore conducted, in pleno, has been found liable.

A circular brass plate, is prepared, like the plate of an air pump, so as to produce with any suitable receivers properly ground, an air-tight juncture. It is supported on the upper end of a hollow brass cylinder, B, with the bore of which it has a corresponding aperture. The brass cylinder is about three inches in diameter, and six inches in height, being inserted at its lower end into a block of

wood as a basis. This cylinder receives below, a screw, which supports a copper tube, C, of about two inches in diameter, so as to have its axis concentric with that of the cylinder, and to extend about four inches above the plate. The copper tube, thus supported, is



closed at the upper termination by a cup of copper, of a shape nearly hemispherical, and soldered at the upper edge, to the edge of the tube; so that the whole of the cavity of the cup, is within that of the tube.

Hence the bottom of the cup is accessible to any body, not larger than the bore of the tube, without any communication arising between the cavity of the tube, and that of any receiver placed upon the plate, over the cup and tube, as in the figure.

Into the side of the cylinder supporting the plate, a valve cock is screwed, by means of which, and a flexible leaden tube, a communication with an air-pump is opened, or discontinued, at pleasure.

The cup being first covered with a portion of the vitrified boracic acid, as anhydrous as possible, and finely pulverized, the potassium is introduced, and afterwards covered with a further portion of the same acid, two parts of the potassium being used for one of the acid. A large glass receiver is now to be placed on the plate, secured by rods A, A, concentric with the tube and cup; from the heat of which the glass is to be protected by a bright cylinder of sheet brass, S, placed around it so as to be concentrical with the receiver and tube.

The apparatus being so far prepared, an incandescent iron is introduced through the bore of the tube, so as to touch the bottom of the copper cup. In a short time a reaction commences, which aiding the influence of the hot iron, renders the cup and its contents red hot. A deep red flame appears throughout the mass, after which the reaction lessens, and the heat declines.

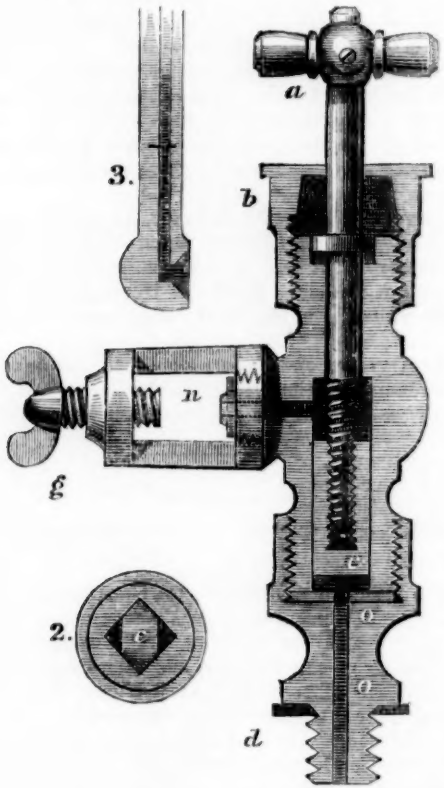
When the cup has become cold, the air is admitted into the receiver, and the contents are washed with water. If any of the acid has escaped decomposition, it may be removed by boiling the mass with a solution of potash or soda. After this treatment and due desiccation, a powder will remain, having the characteristic colour and properties of boron.

The additional valve cock, represented in the figure, gives the option of introducing dry hydrogen for the purpose of washing out atmospheric air, as described in the process for silicon.

Description of the Valve Cock, a perfectly air-tight substitute for the common Cock. By the author of the preceding articles, in which it is referred to.

This figure is intended to illustrate the construction of a substitute for a common cock which I have been accustomed to call a valve cock. It was devised by me about twenty years ago, among a number of other analogous contrivances, and seems upon the whole less liable to fail than any other which I have tried. The engraving represents a longitudinal section of the valve cock. At *a* is a piston with a collar enclosed in the stuffing box *b*, so as to be rendered air-tight by means of oiled leather. Hence this piston may be turned or made to revolve on its axis, while incapable of other motion. Upon the end of the piston a thread for a screw is cut which fits into a female screw in the brass prism *c*, so as to cause this prism to approach to or to retreat from a bearing covered by leather, in the centre of which there is a perforation *o o* communicating with one of the orifices of the instrument. This orifice is surrounded by the male screw *d*, so that

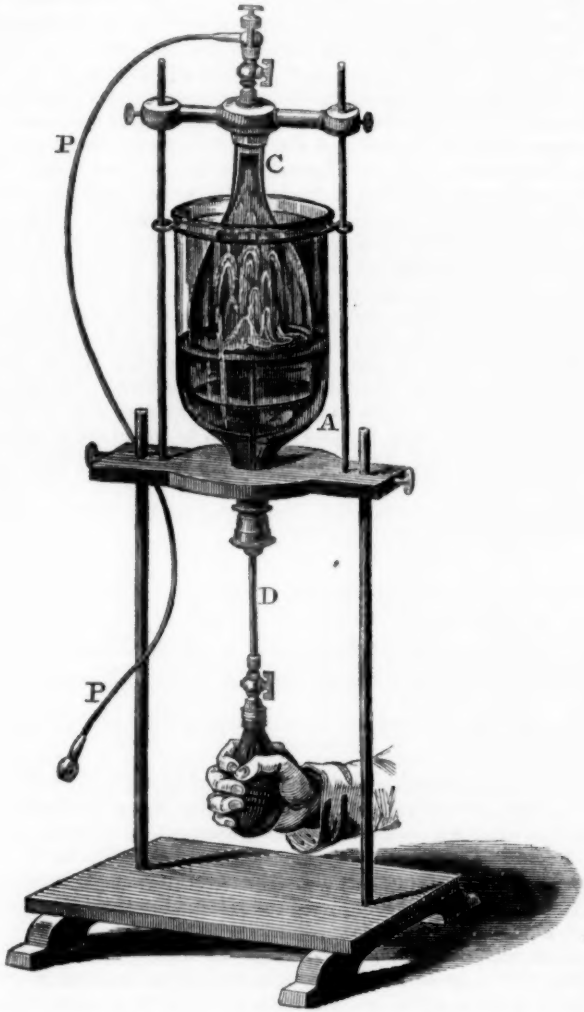
by means of this screw, the valve-cock may be fastened into any appropriate aperture, fitted to receive it, subjecting an interposed leather to such a pressure, as to create with it an air-tight juncture. The prism *c*, has two of its four edges cut off (see fig. 2,) so as to allow a free passage by it, reaching to the lateral perforation terminating in another orifice, over which there is a gallows screw, *g*. By means of this gallows screw, when requisite, a brass knob, such as that represented by fig. 3, soldered to a leaden pipe, may be fastened to the valve cock. The juncture is rendered air-tight by the pressure of the screw in the gallows upon a leather, which is kept in its place by means of the nipple *n*.



The method last mentioned, of producing an air-tight juncture, was contrived by me about seven years ago, and proves to be of very great utility. There is no other mode with which I am acquainted, of making a perfectly air-tight communication, between cavities previously separate, at all comparable to this in facility.

Apparatus contrived by Dr. Hare for separating Carbonic Oxide from Carbonic Acid, by means of Lime Water.

Lime water being introduced in sufficient quantity into the inverted bell glass, another smaller bell glass, C, is supported within it as



represented in this figure. Both of the bells have perforated necks. The inverted bell is furnished with a brass cap having a stuffing box

attached to it, through which the tube D, of copper, slides air-tight. About the lower end of this tube, the neck of a gum elastic bag is tied. The neck of the other bell is furnished with a cap and cock, surmounted by a gallows screw, by means of which a lead pipe P P, with a brass knob at the end suitably perforated may be fastened to it, or removed at any moment. Suppose this pipe, by aid of another brass knob at the other extremity, to be attached to the perforated neck of a very tall bell glass filled with water upon a shelf of the pneumatic cistern; on opening a communication between the bells, the water will subside in the tall bell glass, over the cistern, and the air of the bell glass C being drawn into it, the lime water will rise into and occupy the whole of the space within the latter. As soon as this is effected, the cocks must be closed and the tall bell glass replaced by a small one filled with water, and furnished with a gallows screw and cock. This bell being attached to the knob of the lead pipe, to which the tall bell had been previously fastened the apparatus is ready for use. I have employed it in the new process for obtaining carbonic oxide from oxalic acid, by distillation with sulphuric acid in a glass retort. The gaseous product consists of equal volumes of carbonic oxide and carbonic acid, which, being received in a bell glass communicating as above described by a pipe with the bell glass C, may be transferred into the latter, through the pipe, by opening the cocks. As the gaseous mixture enters the bell C, the lime water subsides. As soon as a sufficient quantity of the gas has entered, the gaseous mixture may, by means of the gum elastic bag and the hand, be subjected to repeated jets of lime water, and thus depurated of all the carbonic acid. By raising the water in the outer bell A, the purified carbonic oxide may be propelled, through the cock and lead pipe, into any vessel to which it may be desirable to have it transferred.

Remarks on the error of supposing that a communication with the Earth, is necessary to the efficacy of Electrical Machines.

By R. Hare, M. D., Professor of Chemistry in the University of Pennsylvania.

Sometime since, in looking over a volume of Cavallo's Electricity, I was surprised to observe that in order to give the greater efficacy to an electric machine, he advises that the cushion, or negative poles, should be made to communicate advantageously with the earth. As the means of accomplishing this object he suggests a conducting communication "with moist ground, with a piece of water, or with the iron work of the water pump."

It appears from the following passage in Turner's Chemistry, a work generally of great merit, that the erroneous impression which gave rise to these suggestions, has been adopted by a more modern author. We find, page 77, American edition, the following allegation.

"The electricity which is so freely and unceasingly evolved during the action of a good electrical machine, is derived from the great reservoir of electricity, the earth. This is obvious from the fact that if the whole apparatus is insulated, the evolution of electricity immediately ceases; but the supply is as instantly restored, when the requisite communication is made with the ground. In the state of complete insulation, the glass and prime conductor are positive as usual, and the rubber is negatively excited; but as the electricity then developed is derived solely from the machine itself, its quantity is exceedingly small. When the machine is used, therefore, the rubber is made to communicate with the earth. As soon as friction is begun, the glass becomes positive and the rubber negative; but as the latter communicates with the ground it instantly recovers the electricity which it had lost, and thus continues to supply the glass with an uninterrupted current. If the rubber is insulated, and the prime conductor communicates with the ground, the electricity of the former, and all conductors connected with it, is carried away into the earth, and they are negatively electrified."

I conceive that the earth has never, of *necessity*, any association with the phenomena of the electric machine; of which the power is evidently dependent on the efficacy of the electric, in transferring the fluid from the negative to the positive conductor. When the machine is made to act and conductors are both insulated, they are brought into states of excitement as opposite as the power of the machine is, at the time, competent to produce. If, under these circumstances, with one end of a metallic rod, (terminating in a metallic ball, or other suitable enlargement, and held by means of an insulating handle,) we touch the negative conductor, while the ball is approximated to the positive conductor, sparks at least as long, and as frequent, will be obtained, as when the negative conductor, or cushion, has the best possible communication with the earth. I conceive that any metallic surface or surfaces, duly connected with either conductor, must become virtually a part of that conductor, and partake of its excitement. In this predicament, whilst receiving a charge, are the coatings of a Leyden jar, or an association of such jars in a battery. The effect of the machine is merely to transfer the fluid from one surface to another. After the conductors, and any jar, or battery, associated with them are charged, there is no more electricity in the surfaces than before; since whatever one has gained, the other has lost.

If the impression of the learned professor were correct, how could a battery or a jar be charged, where both it, and the machine are insulated from the earth? Yet experience shows that it is under these circumstances that a charge is most easily imparted. When the conductors are in a state of excitement, and both insulated, the one will of course be as much below that of the surrounding neutral medium, and of the great reservoir, as the other is above that standard. When we connect either conductor with the earth, it returns of course to the neutral state of the earth; but the difference between the excitement of the conductors is sustained by the power of the machine to the same extent as before; hence the length and frequency of the sparks will not be found to be sensibly altered. It follows that when either of the conductors is made neutral by connexion with the earth, that the other will have its excitement as much above

or below neutrality, as the sum of the difference between each of the two conductors and the terrestrial neutrality when both are insulated. Thus supposing that when insulated, the one conductor is, relatively to terrestrial electricity, minus ten, and that the positive conductor is plus ten; when the negative conductor alone is uninsulated, the positive will be plus twenty, when the latter is alone uninsulated the former will be minus twenty.

It seems to be a common, though as I believe an erroneous idea, that a spark changes its character with the conductor from which it appears to be taken; so that when produced by presenting a body to the positive conductor, it is considered as positive, and as negative when produced with the negative conductor in like manner.

I have already observed that any conducting surface in connexion with either conductor, must act as a part of that conductor. Approximating to the negative conductor, a body (a ball, for instance,) while in communication with the positive conductor, is really enlarging or elongating the surface of the latter, so that when the spark passes, it must still be from the positive to the negative pole: and vice versa, elongating the surfaces associated with the negative conductor, till sufficiently near the positive conductor to receive a spark, does not alter the character of the phenomenon. In each case, according to the theory of one fluid, a current passes from the positive to the negative pole, and according to the doctrine of two fluids, two currents pass each other.

The cause of the difference observed in the sparks in the two cases is, that they are usually received from a small knob upon a big ball, or the hand; or some other body comparatively large.

Whenever the fluid is contracted into a small jet on the positive side, its projectile power is increased; while under the opposite circumstances, its projectile force is lessened. This is the sole cause of the long forked erratic form, of what is called the positive spark; and the short stubbed appearance of what is called the negative spark. The whole difference may be effected in whatever situation the sparks may be taken, by causing a large and a small ball to exchange sides. When the surface on the positive side is so small as to condense the electric matter before it jumps, the projectile force is greater, and, as in the case of the jet pipe in hydraulics, there is a medium size at which the greatest projectile power is obtained. When the emitting surface is too large, the projectile force is lessened, and the spark consequently made shorter.

The following passage in Cavallo's Electricity is that alluded to above. See vol. 1st, page 184: London, 1786.

"Sometimes the machine will not work well because the rubber is not sufficiently supplied with electric fluid; which happens when the table upon which the machine stands, and with which the chain of the rubber is connected, is very dry, and consequently in a bad conducting state. Even the floor and the walls of the room are in very dry weather bad conductors, and they cannot supply the rubber sufficiently. In this case the best expedient is to connect the chain of the rubber, by means of a long wire, with some moist ground, a piece of water, or with the iron work of the water pump, by which means the rubber will be supplied with as much electric fluid as is required."

The learned author is, I think, altogether wrong in imagining that the dryness of adjacent bodies can have any ill effect. In common with the great mass of electricians of this time, as well as his contemporaries, he has overlooked a real cause of deterioration. I allude to the imperfect conducting power of cushions, made as they are usually, of silk, or leather stuffed with hair, or other nonconducting substances. The desiccation of the cushion and other parts of the rubber, may counteract the benefit otherwise produced by any increase of aridity in the surrounding medium.

By stuffing the cushions with the elastic iron shreds scraped off from weaver's reeds in manufacturing them, and making a communication between the shreds and the steel spring supporting the cushion and attached to the negative conductor, I have seen the sparks yielded by a machine more than trebled in length, and frequency.

As a coating for the cushion, upon the whole, I find the aurum musivum, more efficacious than the amalgam usually employed, which is apt to adhere to the glass, and promote the passage of sparks from the cushion to the collecting points of the positive conductor. I question if the amalgam does not owe its efficacy to its conducting power, which tends to compensate the absence of this property in the cushion.

In speaking of experiments performed by means of electrical machines, the poles and conductors may in general be treated as synonimous; yet strictly the poles are those parts of the conductors, or conducting surfaces in connexion with them, between which the discharge takes place; so that when insulated metallic rods, however long, are each at one end in contact with the conductors of the machine, the poles may be at the other ends of the rods. This view of the subject is generally recognised in the case of Voltaic series, which not being terminated by conductors, in the technical sense used in speaking of the machine, gives rise, in this respect, to less cause of misapprehension.

I conceive it an error to suppose that the association of a large conductor with a machine contributes to the intensity of the sparks. It appears to me to render the sparks shorter, and less frequent, though otherwise larger.

Notice of the application of the process of transferring to the art of Die Sinking.

By Franklin Peale, Lecturer on Machines in the Franklin Institute.

TO THE COMMITTEE ON PUBLICATIONS.

Gentlemen,—Several years since it was desirable in the management of the Philadelphia Museum, to be possessed of appropriate medals; for the accomplishment of this object, dies, the device of which was a portrait of Charles W. Peale, were executed in a most satisfactory manner by Mr. C. Gobrecht. One of these dies was unfortunately cracked in the hardening, and thus rendered useless.

It subsequently became still more desirable that this object should

be carried into execution, and that the likeness of the founder of the museum should be preserved. A prosecution of the subject led to the results which I will now state.

In the spring of 1825, Mr. M. W. Baldwin, aware of the applicability of the process of transferring, to die sinking for coinage, made at that time a transfer press, with which Mr. Kneass, of the United States Mint, made a perfectly successful experiment in the workshop of the former.

The object above stated led to a revival of this process, and its prosecution to completion, and I have now the pleasure to present to the Institute one of those medals, stuck in silver, from dies which were made in the fall of 1832 by *transfer*, from the originals engraved by Mr. Gobrecht. I do not offer this medal as a sample of workmanship in this department of the arts: the first specimen in any art is generally, from that circumstance alone, inferior; but it is offered as a creditable specimen, and at the same time a satisfactory demonstration that the process of transferring is applicable to die sinking, with advantages that may be stated in a few words. The first of these advantages is great economy of labour. Any required number of dies may be taken from the original roller, all of them being fac similes of the original die. The process exercises, also, an advantageous effect on the metal, in raising it gently, and by successive efforts, with an equal condensation of the particles throughout all the portions of its surface, admitting at the same time of as many annealings as the *relief* of the device may require; of which the limits, as far as I can judge from my experience, are beyond the requisite elevation. From these facts I am fully authorized in believing that the risk of loss of the nearly finished work by cracking, in hardening, is much reduced.

A brief notice of the process, (which is applicable to all kinds of dies,) for general information, is all that I need offer, as an intimate knowledge could only be acquired by conducting it.

The die is engraved in the usual manner, except that it has a greater width of margin. It is then hardened and placed in the press, in contact with a soft roll, and subjected to the necessary pressure and roller, with occasional annealings, as may be found necessary, the frequency of which will depend on the depth of the device. The roll is then hardened, and the operation repeated with the substitution of a soft die, to receive the impression from the hardened roll; the die is then prepared and hardened in the usual manner; the roll being preserved to repeat the transfers, as often as may be desired.

The process of transfer is now used in the engraving department of the U. S. Mint, under the direction of Mr. Wm. Kneass, to whose liberal aid I am much indebted in the prosecution of this process to its successful completion.

I have the honour to be,
Very respectfully, yours,
FRANKLIN PEALE.

Philadelphia, April 24, 1832.

FRANKLIN INSTITUTE.

Proceedings of the second Monthly Meeting for Conversation on Mechanical Subjects. Thursday, March.

Mr. Franklin Peale exhibited a speaking and a laughing figure, and explained the mechanism of the former by referring to a model in which all the parts were enlarged. The analogy of the parts of the model to those in the mechanism essential to the human voice was satisfactorily traced, and the difficulties incident to the imitation dwelt upon.

A model illustrative of the principles of common as well as of horizontal perspective, was shown by Prof. A. D. Bache, in connexion with the "horizontorium" of Mr. Reuben S. Gilbert, which was presented at the first meeting.

The locomotive engine made for the Museum by Mr. M. W. Baldwin, was placed upon a short section of a rail-way. The construction of the engine was explained by Mr. Franklin Peale. Its analogy to, and differences from, the trial engine of Braithwaite and Ericcson, was shown, and led to a discussion of the principles of construction of the more recent locomotives.

Two transparencies, illustrative of the early history of the steam engine were placed at the upper end of the hall. They form part of a series procured with the proceeds of a contribution, by members of the Institute, towards the collection of models, &c. for the lectures on Machines.

Quarterly Meeting.

The thirty-seventh quarterly meeting of the Institute was held at their hall Thursday, April 18th, 1833.

S. J. Robbins was appointed chairman, and

C. Sherman, Recording Secretary pro. tem.

The minutes of the annual meeting were read and approved.

Donations of books were received from Messrs. Thomas Stewart, Reuben S. Gilbert, S. J. Robbins, Abrm. Miller, George Fox, S. V. Merrick, W. B. Sprague, and the Zoological Society of London, which were deposited in the library.

The Actuary laid on the table the various journals which had been received during the last three months in exchange for the Journal of the Institute, which were also placed in the library.

The Chairman of the Board of Managers read the thirty-seventh report of the Board, which was accepted, and, on motion, referred to the committee on publications, with instructions to publish such parts as they may deem expedient.

The treasurer's report for the quarter ending the 1st April, inst. was read and accepted.

Extract from the minutes.

S. J. Robbins, Chairman.

C. Sherman, Rec. Sec. pro. tem.

Thirty-seventh Quarterly Report of the Board of Managers of the Franklin Institute.

The Managers respectfully submit to the Institute an outline of the operations of the last quarter.

In the department of instruction, in addition to the regular lectures, the members have had delivered before them, a series of popular lectures on meteorology, by G. Emerson, M. D., to whom the Board take this opportunity to return thanks for the interest in the institution which prompted his exertions. It is still a matter of regret with the Board that the evenings devoted to volunteer lectures are so generally vacant, notwithstanding the many members who are entirely competent to do justice to an explanation of the branches of the useful arts to which they are devoted.

The efforts of the Professor of Chemistry to make his course useful to the workman, as well as interesting to the general student, have been acknowledged by the regular attendance of the members; those who have listened to his descriptions of the art of the gold beater, iron founder, &c. could not but have perceived that the processes had been the subjects of personal inspection, and that the descriptions were those of an eye witness.

The English school has continued to receive the patronage of the members of the Institute, but not to the extent to which its merits entitle it.

Notwithstanding the arrangements made, at the opening of this year's course, for the better accommodation of the drawing school, the number of the pupils has materially diminished. The causes which may have led to this result are under consideration by the committee on instruction.

The committees of the Board appointed since their organization in January last, have, as appears by their reports, been attentive to the duties assigned to them respectively. The committee on premiums and exhibitions have prepared and published a list of premiums for articles to be submitted at the exhibition of American manufactures to be held next autumn.

Arrangements have been made, by a special committee, to have, on the occasion of delivering the medals and premiums, to be awarded at the exhibition just referred to, a public address delivered by a distinguished citizen of a sister state. It is intended thus to follow up a practice, which was commenced by the delivery of an address by the chairman of the committee on exhibitions, in the winter of 1831.

The managers congratulate the members of the Institute on the success which has attended the commencement of the experiment of substituting conversation meetings for the formal monthly meetings heretofore held. It is hoped that the interest already excited will not be suffered to flag, and that these meetings may afford a new source of attraction to the members of the Institute.

Respectfully submitted.

A. D. Bache, *Chairman.*

William Hamilton, *Actuary.*

Bibliographical Notice.

A Treatise on Optics, by Sir David Brewster, *LL. D. F. R. S., &c. &c. First American edition, with an appendix by* A. D. Bache, *Professor of Natural Philosophy and Chemistry in the University of Pennsylvania, &c.* Carey, Lea, & Blanchard, 1833.

The treatise on optics by Sir David Brewster is from the pen of the most successful experimental inquirer, in this branch of science, since the days of Newton, and coming from such a source it needs no eulogium from us. The reader will find in this work a clear statement of Sir David Brewster's discovery of the decomposition of light by *absorption*, and the consequent modification of the theory of the spectrum; his curious inquiries into the colours produced by grooved surfaces; into the laws of the double refraction and polarization of light; and the various phenomena embraced in these interesting branches of optical science. These, as well as the other parts of the subject, are treated in as popular a form as the nature of the science admits.

The motive which induces us to withhold a detailed notice of the body of the work, applies with greater force to any notice of the appendix, a statement of the object of which we give in the words of the editor's advertisement.

"The object of the following appendix is to place in the hands of the students of our colleges, a text book which will furnish them with some of the analytical methods of the most recent writers upon the elements of optics."

"The work of Sir David Brewster is from the pen of a master, and presents, in a popular form, the results which have flowed from experiment and from theory, applied to the investigation of the different branches of optics. The appendix merely aims at supplying to the student the mode of determining the results given in the text, more particularly in what relates to reflexion and refraction."

AMERICAN PATENTS.

LIST OF AMERICAN PATENTS WHICH ISSUED IN NOVEMBER, 1832.

*With Remarks and Exemplifications, by the Editor.**

1. For an improvement in *Stoves;* Nathan Parrish, Mendon, Monroe county, New York, November 2.

The stove here patented resembles, in its general construction, the kind ordinarily used for cooking, such as the old ten plate, or other stove of that description; to these the patentee proposes to make an addition, for the purpose of burning longer wood than they usually allow, and of throwing more heat out into the room. Suppose the fireplace door to be removed, and the opening to be surrounded by a rectangular box, each side of which is as large as the door, the door being used to form the front of it, and the lap of the stove to form its bottom; this box being fixed on to the stove plate by screws, or otherwise, the door being outwards, the fireplace will be thus lengthened to an extent equal to the sides of the box. This, it is said, will not only accomplish the purpose of burning longer wood, and throwing out more heat, but likewise improve the draft.

If instead of burning longer wood, this addition would cause wood to burn longer, we should think more favourably of the contrivance. A box of the kind described, when added to a common stove, will cover nearly the whole lap, and will not only appear unsightly, but be actually very inconvenient, as it will render it difficult to get at the coals and ashes within the fireplace, and the longer wood will be confined to the additional box.

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2. For a *Machine for manufacturing Axes,* Hatchets, and other tools; David Hinman, Winchester, Litchfield county, Connecticut, November 2.

The machinery used is described in very general terms, leaving, in its application, much to be reinvented by any one who should undertake to construct it from the specification and drawing deposited in the patent office. It appears, however, that there are to be two wedge-like pieces, the heads of which are segments of cylinders, and between these curved ends, the forging, or swageing is to be effected; there is to be a strong iron frame, within which these two pieces, which are called folding arms, are to be hung upon pins at their thinner ends. Upon the curved heads swages are to be placed, having the form adapted to the axe, or other article to be forged. These wedges, or segments, are made to vibrate by means of a crank and pitman, and, according to the drawing, they are to be forced up against each other by a kind

* In the list of patents in the last number, the following was omitted:—

48. For an improvement in the mode of *Cutting Laths by means of Circular Saws;* Francis Shumard, Cincinnati, Hamilton county, Ohio, October 31.

The specification of this patent will be found in the present number.

of windlass, thus following the metal as it enters the dies. The claim is to "the application of power, giving to the metal a squeeze or pressure in one direction only."

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3. For an improvement in the *Manufacture of Axes:* Benjamin Smith, Canton, Hartford county, Connecticut, November 2.

This patent differs altogether from the foregoing, as it is for an apparatus to be employed for finishing axes after the forging has been completed. Circular steel cutters are to be made to run in a lathe strongly mounted for that purpose. These cutters are to be employed as substitutes for the file and grindstone. One of them is made concave lengthwise, so as to be adapted to the convexity of the axe on its sides towards the cutting edge. The cutter, after being turned to the proper form, is to be grooved spirally, from end to end, so as to have cutting edges over its whole surface. Other cutters are adapted to the head, and to the back and front edges. The eye also is to be dressed, or drilled out by means of a fluted taper bit, running in the lathe; the small end of the bit working out the lower part, the same conical bit entering further to complete the upper or larger part of the eye.

The axe is to be laid on a sliding bed, where it is held by tightening screws, and advanced against the cutters by racks and pinions, or other suitable means. "The thing claimed by the applicant as his invention, is the adaptation and application of the mill, or cutter, above described, to the specific purpose of shaping axes."

Such cutters can be applied only where axes have been formed between dies so as to give to all of them precisely the same shape; they may then be used, but we much doubt, even in that case, their being found to be eligible instruments for finishing axes. They must be of hardened steel, and as they become dull they cannot be sharpened otherwise than by softening, filing, and rehardening them; the trouble and risk of which will be apt to render them inferior to the old mode of proceeding; to the drilling part we see no objection.

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4. For an improvement in the *Common Spindle for Spinning Cotton;* Nathaniel Rider, Dudley, Worcester county, Massachusetts, November 3.

The common live spindle is to be surrounded by a tube along that part of it upon which the bobbin is usually placed; this tube is to receive the bobbin, which then occupies the same part, in relationship to the flyer and whirl, which it would were the tube not there; the bobbin is also made to rise and fall on the tube as it would on the naked spindle. The advantage said to result from this is, the creation of a friction which gives an easier and more steady draft, especially when the motion is rapid. The washer, it is stated, should be much smaller than that now in use on the live spindle. The claim is to the particular form of the tube, and the metallic washer. The drawing which accompanies the specification is without written references, but those

acquainted with the subject, will perceive the nature of the thing claimed.

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5. For an improved mode of *Moving the Rudders of Ships* in steering; Elijah Soule, Duxbury, Plymouth county, Massachusetts, November 3.

The steering is to be effected by means of a cogged wheel which works in a rack, forming the segment of a circle. This circular segment is affixed to the deck, at its two ends, by metallic pillars, or standards. The hangings of the rudder are the centre of the circle of which the curved rack is a segment. The steering wheel is to be made in the ordinary way, but it has a pinion on its axis which takes into the upper side of the cog wheel, the lower side of which mashes into the rack. The uprights, which support the steering wheel and its appendages, are securely fastened on to the end of the tiller, and traverse with it in steering. There is a contrivance for keeping the rack and cog wheel in gear, and preventing derangement from blows and jerks.

The claim is to "the application of the steering wheel and pinion on its axis, and the cogged wheel to the curved rack, or segments, to produce a motion of the rudder either to the right or left."

Instead of the mode of fixing the rack and pinion above described, it is proposed sometimes to attach the rack firmly to the tiller, and the standard of the steering wheel to the deck. This latter mode we should suppose to be the best, as the steersman will then keep his station opposite to the binnacle, whilst in the former mode he has to follow the tiller towards either side of the vessel.

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6. For a *Washing Machine;* William H. Cumming, Greensboro, Guilford county, North Carolina, November 3.

The clothes, contained in a trough, are to be rubbed between a reeded cylinder, or one covered with small rollers, and a hollow segment of rollers, in a way so much like that adopted in many other washing machines. The patentee has not presented to us any thing which he claims as new, a point in which we think that he has pursued a correct course.

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7. For an improvement in the *Reaction Water Wheel;* William Hotchkiss, Windsor, Broome county, New York, November 6.

Hereafter the millwright must take especial care to place the shaft of his reaction wheel perfectly plumb, as in the patent before us the wheel makes not the slightest pretention whatever to novelty, being as like to Mr. Wing's wheel, and some others, in the arrangement of its buckets, as one pea is like another; but, says the patentee, "the parts to which I lay claim as original, are the placing the horizontal or reaction wheel in a vertical, or other position than a horizontal one, thereby, in saw mills, and in all places where a crank is used, saving the expense of gearing the same, and also of constructing said wheels

wholly, or principally, of cast iron, or other metallic substance. And also of placing more than one of said wheels on the same shaft or axle; or of coupling two or more of said shafts together," &c.

There seems to be something of a bull in the idea of placing a horizontal wheel vertical, but this would not be of much importance were there *any other* novelty in the thing proposed; it, however, happens that not only the vertical position of the said horizontal wheel, but each of the items above enumerated and claimed, are equally unfortunate in this particular. The security of the standing of these claims, therefore, is about the same with that of the "baseless fabric of a vision."

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8. For a *Machine for Pressing Paper;* Ashael H. Jervis, and Thomas Trench, Ithaca, Tompkins county, New York, November 6.

Two hollow metallic rollers about two feet long, and six inches in diameter, are to be turned perfectly true, and polished; the upper of these rollers is to be borne down on the under one by weighted levers. The paper to be pressed is carried to the rollers by a feeding table, which is an endless apron; upon this it is held by four small rollers which are made to revolve with a speed somewhat less than that of the pressing rollers, for the purpose of holding it, and causing it to pass through smoothly. The paper pressed is received upon a second endless apron, and deposited by it in a box, or trough. Either hot or cold pressing may be performed by this machine.

The patentees state that such a press is now in use at the Falls Creek paper mill, Ithaca, which presses from twenty to thirty reams per day. That the quality of the paper is improved, and much labour saved.

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9. For a *Machine for Raising Water;* Philip Tusing, Brooks' Gap, Rockingham county, Virginia, November 7.

In examining the *inventions* which are patented we are perpetually called upon to employ the degrees of comparison, and are enabled frequently to say *good*, sometimes *better*, but not knowing what may hereafter come, we never dare venture upon the term *best;* when, however, we come to the descending degrees, *bad*, *worse*, *worst*, the task is usually more easy, as, although it is no gratifying part of our duty, we are compelled, unhesitatingly, to place many patented contrivances in the latter class. The affair before us must, for a short time at least, stand at the foot of this list; it is not improbable, however, that by to-morrow it may stand go up one.

The machine for raising water here patented, consists of an overshot wheel, the shaft of which is to give motion to an endless chain of buckets, and these are to deliver the water from a reservoir below, into one above the wheel; this water is to keep the wheel in motion, and, of course, to perform some other labour. Should it be employed to work a guillotine, and the first culprit condemned to lose his head

by its agency be permitted to live until the axe is raised by the power applied, we are ready to insure him immortality.

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10. For an improvement in the *Turning Lathe;* John Bisbee, Plainfield, Hampshire county, Massachusetts, November 8.

The lathe here described is intended for turning sticks, used for broom handles, or other purposes, either straight or tapering, and with such ornamental beads, or mouldings, as may be required.

A sliding cat-head, of cast iron, has a hole through it, of such size as just to admit the stick when it has been rounded by a gouge fixed for the purpose. A lever attached to, and working on, a pin in the cat-head, carries a second gouge and a smoothing chisel, the gouge cutting the stick to the size required, and the smoother finishing it as it passes through the hole. There is a contrivance for allowing the cutters to advance for the purpose of making the stick taper, and what is called a buzz, for forming the ornamental parts. The particular construction of the mandril, and of the front centre, are described by the patentee, but those and the other parts relied on as new are not sufficiently well represented in the drawings to give an exact idea of them, so as to enable a workman to make them without exercising his inventive powers. We again repeat the fact that it is of little consequence, in a legal point of view, that they may be understood from an examination of the model; this, we have often said, makes no part of the patent, as it cannot be placed on file, or published for the information of the community.

The claims made are to the "giving the cat-head such a form that the second cutter, or gouge, and the smoother may be connected with it, and at the same time be raised or lowered by a rest; and placing the edges of the dies in such a position as to cut naturally and smoothly to any size wanted; also the turning buzz, however it may be applied; the hole and piece in the end of the centre pin; the sliding rest, and the moveable spindle, or mandril, with its ring edge, and edge across its centre."

Where claims are made, in this way, to the individual contrivances appended to an instrument so long and universally employed as the lathe, there is no small danger of following in the track of a preceding traveller. Cutters in sliding heads, sliding mandrils, buzzes, moveable centres, and most of the things above enumerated have been repeatedly and variously applied; we think, therefore, that the claim in a case like the foregoing, should be to the general arrangement and combination of the respective parts described, so as to produce the effect intended, and set forth in the description.

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11. For a machine for *Sawing Gun Stocks;* Abraham Myers, Boonsborough, Washington county, Maryland, November 9.

Saws are to be worked up and down in a frame, by the crank of a common saw mill; three saws are named, two of which are to be cut longitudinally, and the third to cross cut the ends of the stocks. The plank is to be laid upon a platform, and bellows are to be moved by the machinery, in order to blow away the saw dust. The platform

upon which the plank is laid, is particularly claimed; as also are the bellows for blowing away the saw dust, and the general arrangement of the whole. If there is any thing new in the whole of this contrivance, it is the windy part alone. In numerous machines saws are worked precisely as these are, and, we apprehend, always with a platform upon which to lay the plank to be sawn, as it would be difficult, if not impossible, to give it a firm aerial foundation.

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12. For an improvement in the *Art of Distilling* Spirits from Grain; Lewis Johnson, November 9.

The usual method of making a mash of rye meal, malt, hop water, and yeast, is detailed by the patentee, who states that it is followed by him, but that he has an improvement, which consists in an addition of ardent spirits, generally of rye whiskey, at the time the yeast is put in; the quantity of spirits being from half a gallon to three quarts, for every 100 lbs. of meal. The effect produced by this addition, is said to be, that the *stalk yeast* is rendered more powerful in *working off the chop or grain mash* into alcohol, or spirits, and the obtaining of from one to two quarts more of spirits from every 60 lbs. of *chop*. It is said also to prevent the souring by standing, which sometimes takes place.

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13. For a *Machine for Planking Hats;* George and Edwin Page, Manchester, Hartford county, Connecticut, November 9.

A wheel, or drum, five or six feet in diameter, the periphery of which is formed of plank, is hung by its axis on a suitable frame. The whole is to be covered with cloth. A semicircular segment, made of plank, is placed under the lower side of this wheel, and comes at each end nearly up to its centre, and is borne up against it by weighted levers; this is called the planking apron, and between it and the revolving drum the bodies to be planked are rolled, by the turning of the wheel. One face of the wheel, near its periphery, is surrounded by cogs; an iron shaft crossing the wheel from side to side carries two segment pinions, one of which has seven and the other three teeth on it; these taking into the cogs on the opposite sides of the wheel turn it in reversed directions, the one with seven carrying it forward, and the one with three backward, thus rolling the bodies backward and forward as they pass between the planking apron and the wheel. A kettle made in a form which adapts it to the wheel and apron, receives them at their lower sides. A planking board is fixed at that end of the apron where the machine is fed by the workmen.

There is no claim made, the whole machine, we suppose, being considered as new.

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14. For *Rail-road Cars, to run on Curves;* Samuel Snyder, Lancaster, Pennsylvania, November 10.

A piece of scantling passing along under the centre of the car, forms a perch, on the middle of which a hinge, or rule joint is form-

ed, but in one of the pieces the hole to receive the pin is to be lengthened to form a slot, or mortice, admitting of the lengthening of the perch to a certain extent. The axles for the wheels are to be fastened to the perch by their middles, and this contrivance is to admit of the car passing on curved roads. In this there is nothing new in principle, and, we are well convinced, nothing good in practice. The patentee proposes to adopt the common lock bar of wagons as a brake to come in contact with the wheels when the horse holds back; this, we suppose, is to aid him when descending on inclined planes. The whole affair does not appear likely to come into very extensive use.

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15. For a *Rotary Steam Engine;* William Jones, Bradford, Orange county, Vermont, November 10.

This rotary engine looks as promising as most of the members of the same family, but like many other promising children, it will in its course disappoint the anticipations of its parents. Upon this point we may speak with undoubting confidence, because there is nothing new either in the principle upon which it operates, or in the arrangement of its individual parts, excepting we admit a mere change of shape to be a new arrangement. One cylinder revolves concentrically within another, there being sliding valves, borne out by springs, which fill the chamber between the two cylinders, and retreat within the inner one by the action of a fixed stop, which forms an inclined plane attached to the inside of the outer cylinder. An induction and eduction pipe admit and discharge the steam in the usual way. The claim is to "the before described rotary engine."

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16. For a *Corn Sheller;* Daniel Hall, Strasburg, Lancaster county, Pennsylvania, November 12.

A cast iron cylinder, twenty inches long and seven in diameter, is covered with teeth, formed like saw teeth, which are to shell the corn. There is so little difference in the action of this and some of the earlier machines for the same purpose, that we do not think it necessary to say much about it; particularly as there is no claim made, and the drawing itself is not descriptive, and has no written references, as required by law.

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17. For *Wheels and Axles of Locomotive Engines, and Rails adapted to them;* Richard Berrian, city of New York, November 13.

The principal thing here proposed, is to have cog wheels attached to each of the common wheels, to take into rack rails, on the outside of the ordinary rails; or, otherwise, to have one cog wheel on the middle of each axle, with a rack rail laid for it to work in, to enable the engine and cars to ascend and descend on inclined planes. Those who have made themselves acquainted with what has been proposed and done in this business, need not be told that there is nothing new in the plan, and, as it contains nothing more, it would be a mere waste of time to dwell longer upon it. Had the patents for improvements

in rail-roads and cars been obtained by practical men only, they would have been few in number, and it is not probable that the very same thing would have been the subject of numerous patents, as is now the case.

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18. For an ACCELERATOR, *being an improved mode of applying Horse Power;* Richard S. Schevenell, Orangeburgh district, South Carolina, November 13.

The apparatus which is here patented, is to be applied to the common horse mill, in which the animal walks in a circle. A post is put into the ground at the centre of the horse walk, and from this rises a bolt or pin upon which the lever to which the horse is geared drops, and round which it revolves as a dead centre. The outer end of the lever is sustained by a wheel, or wheels, which run upon a circular rail-way, supporting the lever in a horizontal position. The vertical shaft has a gudgeon on its lower end, the step of which is on the upper end of the bolt, or pin, which receives the horizontal lever. This shaft, therefore, is completely detached from the lever, and would remain at rest whilst the horse walked round were it not for certain wheel work by which the lever is geared to it. Of this gearing machinery it is unnecessary to give a particular description; suffice it therefore to say that at the lower end of the shaft there is a pinion driven by wheels which cause the shaft to revolve several times whilst the horse goes round once. According to the patentee, "the advantage in this machine is, that I obtain two-thirds of the horse lever, whereas, in the machines generally, only one-third of the lever is obtained. The economy of animal power, with the great velocity of which it is susceptible, will, I am sanguine, render this machine peculiarly applicable for every species of mill."

We have had occasion to describe the gearing of some horse mills, intended to give an accelerated motion, but they have differed from the present in operating at the upper instead of the lower end of the shaft; in one thing, however, they agree together, namely, in violating the universal principle in mechanics, that what is gained in power is lost in time, or rather, conversely, what is gained in speed, (time,) is lost in power; a rule which applies to the bottom as well as to the top of a vertical mill shaft. This being the case, we are not "sanguine."

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19. For a *Binnacle Lamp;* William Lawrence, Meriden, New Haven county, Connecticut, November 14.

The body of this lamp, in which the oil is to be contained, is made in the manner of that of the astral lamps, with two shells, which when united form a ring-like reservoir. The outside of the lamp is to be six inches in diameter, and the opening in the middle two inches. Tubes for the wicks are to rise from the upper edge, and project over the opening, so as to throw a light down upon the compass. The inner shell is to be brightly polished, that it may serve as a reflector.

The lamp is to be hung by gimbals, in the manner of the common compass.

The claim is to "the peculiar construction of the lamp as above described, and the *application* to it of the common and well known principle of suspending the mariner's compass, as specified above, whereby the horizontal position of the lamp, and the diffusion of light down upon the compass, will be preserved, notwithstanding the rolling of the vessel."

On the 23d March, 1831, Mr. Lawrence obtained a patent for a hanging lamp, constructed as above, an account of which, with a sketch, will be found in vol. viii. p. 18. He cannot now, therefore, make a valid claim to the peculiar construction of this lamp, for he would, in that case, have two patents for the same thing. The hanging of lamps on gimbals is also old, and we do not think that there is enough of novelty in the arrangement and application to sustain a patent; if, in fact, his old patent was good, no one could take his lamp, place it on gimbals, in a binnacle, and thereby make it his own.

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20. For *Circular Elliptical, or Conic Stair Carriages;* Edward B. Smith, Buffaloe, Erie county, New York, November 15.

A mode of marking out and finishing the work in the construction of curved stairs, is given in this specification; it would require more space to explain the proposed procedure than would be acceptable to any but carpenters, and we probably should not render it clear even to them. We think the mode described is, in some respects, an improvement upon that generally followed; as a subject for a patent, however, we do not belive that it will be very profitable. A mere mode of executing work cannot, like a tool, or other machine, be sent over the country, where it may be required, and we apprehend that but few master carpenters, residing in distant places, will write to Buffaloe, and send the money for a right to use the patentee's plan. Sometimes, however, such things are worth patenting for the sake of the employment which it may secure to the individual workman.

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21. For an improvement in *Marine Rail-ways;* Leonard White, Norfolk, Norfolk county, Virginia, November 15.

This marine rail-way resembles so closely some of those previously patented, that after looking over the plan, without perceiving anything in it which we thought original, we turned to the claim at the end of the specification to ascertain from that, the points of difference between this rail-way and its predecessors, but met there nothing more than the words, "What I claim as my invention, and desire to be secured by letters patent, is the before described marine rail-way."

To sustain such a claim, the whole arrangement ought to be new; instead of which, we are inclined to think that the whole, or nearly the whole, of "the before described marine rail-way," is old.

Upon the ribs, or ways, of the inclined plane, a carriage is to ascend by the aid of rollers which extend from side to side of the carriage, and rest upon the ribs. Palls fall into racks on the side of the

inclined plane, and a proper cradle is made to support the vessel, &c. &c. Those acquainted with the subject will perceive that the foregoing parts are such as are common to similar structures, and, as no individual points of difference are designated, there is no evidence of their existence, and if they do exist, they make no part of the patent, not being noticed and claimed.

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22. For machinery for *Hulling and Polishing Rice*, Barley, &c. &c.; Theodore F. Strong, and Marcus T. Moody, Northampton, Massachusetts, November 17.

The seeds are to be first passed between mill stones, the runner being raised so as merely to crush the hull, then after being winnowed they are to pass through the machine for which the present patent is obtained. This machine consists of a truncated cone on a vertical shaft, working within a hollow truncated cone. The edge of the truncated cone, and the interior of the hollow cone are to be covered with cards, or wire points, in such a way that they shall be elastic. In passing between these, the hulling is to be completely effected. When required to be more perfectly polished, the grain is to be passed again through a similar machine, furnished with dog-fish skin, bristles, or other suitable substance. The claim is to the machinery made as above described.

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23. For manufacturing *Fenders for Fireplaces;* Thomas Thomas, and Robert Fuller, city of New York, November 19.

The mouldings required to give the pattern to the fender, are to be formed by circular dies, or rollers, between which the sheet metal is to be passed. An iron frame is made to sustain the rollers, which are fixed upon two shafts geared together by cog wheels of equal size. The moulding rollers stand out from the face of one of the standards, like a chuck on a collar and mandril lathe. The pressure of the rollers upon each other is regulated by screws, like those of a flatting mill.

These rollers are adapted to the forming of the moulding on the plate, whilst it remains straight lengthwise. In order to give the required curvature to the fender, that roller is to be removed which formed the face of the moulding, and another, closely resembling it, is to be substituted; this latter, however, differs from the former in being so made as to press upon, and stretch the projecting parts of the moulding, without affecting the body of the plate; this stretching causes the fender to be curved lengthwise, and that in proportion to the extent to which the operation is carried. In effecting this, a much heavier pressure must be exerted upon the rollers than was necessary in the first operation. As the moulding rollers are supported at one end only, we should apprehend some difficulty in this, and that it will be found necessary, in some instances, to run them between the standards, like those of flatting mills.

"The form of these rollers, and their application to the purpose above mentioned, and particularly the arrangement by which the cir-

cular form is given to the mouldings and edge, forms the novelty for which a patent is prayed."

There is certainly nothing new in the *form* of such rollers, as mouldings have frequently been raised on sheet metal by means of rollers, or revolving dies; it is therefore upon their adaptation to the particular purpose named that a claim to them must rest. We believe that the bending, by means of the secondary rollers, is new.

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24. For an improvement in the *Wool Carding Machine;* Luther Colburn, Fairfield, Franklin county, Vermont, November 20.

The improvement claimed consists in the manner of taking the wool from the card, and forming it into rolls. The wool is to be received from the doffing cylinder on to a smooth board, upon which it is to be rolled by means of an endless apron, the lower side of which is parallel to, and a little above, the board. The rollers which carry the endless apron are different in size; that near the doffing roller is of iron, and not more than an inch in diameter; the more distant one is of wood, and is to be three inches in diameter.

The patentee states that his plan is very superior to that commonly pursued, in which an iron crank, a steel comb, a roller of ten or fifteen inches diameter, a shoe or shell, and many other fixtures, are required, with which he dispenses. His apparatus, he avers, is considerably less expensive, works without noise, and is much less liable to get out of order. The claims made are to the individual parts of the apparatus, as, for example, "The iron roller or shaft; the wood shaft or roller; the apron; the board, with all the apurtenances thereunto belonging." It would have been better, we think, to have depended upon the general arrangement of the machinery for producing the effect in the manner described.

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25. For *Securing Frame Buildings from the effects of Heat, Frost, or Moisture,* from without; Ebenezer Mix, Batavia, Genesee county, New York, November 22.

Between the weather-boarding and the interior plastering there is to be an intermediate division of lath and plaster, which is to be placed there after the weather-boarding has been finished, and previous to lathing for the interior of the rooms. The air imprisoned between the two fastenings, being a bad conductor of heat, will, it is said, produce the desired effect.

There would, no doubt, be much advantage derived from this procedure, but, at the same time, there would be a considerable increase in the cost of building; an increase which would, in most situations, render a frame building nearly as expensive as one of brick.

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26. For a *Machine for Washing Gold and other Ores;* William Davis, late of Great Britain, but now of Faquier county, Virginia, he having declared his intention to become a citizen of the United States, November 22.

(See specification.)

27. For a *Washing Machine;* Eli Nichols, Union, Belmont county, Ohio, November 24.

In all its essential parts this new washing machine is rather old. A round tub is to be fixed upon a vertical shaft, placed under its centre, in such a way as to enable the tub to revolve readily therewith. A fluted cylinder, or rather a truncated cone, turned by a crank, has its periphery resting on the bottom of the tub, its gudgeons being sustained by the frame work. When this is turned, the tub also revolves, and any clothes contained in it will pass under the fluted roller. A hoop, or some similar contrivance, surrounding the centre, and resting on the bottom of the tub, converts it into a circular trough, and keeps the clothes to be washed under the roller. The gudgeons of the roller run in slots, admitting it to rise and fall, according to the thickness of the clothes beneath it.

We recollect two patents, at least, for a similar affair; the present patentee, however, appears to consider the whole as new, he not having made any claim whatever.

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28. For a *Gum Elastic Bathing Cot;* Walter C. Palmer, city of New York, November 24.

A bathing trough is to be formed by using gum elastic cloth, or other water proof material, which is to be suspended to a frame like that of a cot. The patentee claims "the application of cloth, or other flexible material, rendered impervious to water, by any means, to the purpose of bathing, by attaching the same to a frame in such manner as to give it the form and capacity necessary for a bath."

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29. For an improvement in *Clocks;* James S. Seger, city of New York, November 27.

This improved clock is not destined to take the place of chronometers, or of time keepers made for astronomical purposes; we believe, however, that it possesses novelty, and, compared with clocks in general, it has great simplicity. A piece of board six inches square forms the foundation of the clock; and this it is proposed to hang upon a nail in a wall, by a ring placed at one of its angles. Into the centre of this board a round steel pin is driven, which receives the pipe or barrel of a fling wheel, the diameter of which is nearly equal to that of the board. Just above the teeth of the fling wheel another piece of steel is driven, which forms a knife edge suspension for the pendulum. This latter is a long bar, say of two feet, weighted at each end, and hung in a horizontal position upon the knife edge like a scale beam; a part of the pendulum on each side of the point of suspension extends downwards so as to form pallets, acting upon the teeth of the fling wheel, and thus constituting the escapement.

The face upon which the hours and minutes are marked is a flat circular rim, which is merely hung upon the pipe of the swing wheel, and is furnished with teeth, or notches, which must, we suppose, fall into corresponding teeth on the outside of the pipe, although we are not so informed in the specification. A second, but smaller circular

rim is also hung upon the same pipe, and has a projecting part upon it which constitutes the hour hand. The size of the openings, and the number of notches on these suspended rims must be so calculated as to correspond with the other parts of the machinery. A weight acting upon the pipe, or barrel, of the fling wheel, is the maintaining power. A fixed wire extending from the centre pin to the knife edge, serves the purpose of a minute hand, as the suspended rim revolves beneath it.

The claims are to "the operation of the escapement wheel, revolving on a pin or pivot, instead of being made fast to, and being solid with a pinion, as in the usual way. The whole and entire operation of the circular rims, or faces, or dials, for the purpose of ascertaining the time. The application of the pallets and pendulum in one solid piece, or combining them both in one."

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30. For an improvement in *Saw Mills;* David W. Hall, Sparta, Hancock county, Georgia, November 27.

"The invention here claimed consists in the regulating screws, nuts and blocks by which the saws are kept at a proper distance apart; the bar, hooks, and screw-bolts for tightening the saws; the screw-rods, nuts, and blocks, passing through the fender posts, and placed above the log to be cut, for stiffening the saws without making the saw gate so heavy as is common in order to accomplish this object;—and the cylindrical rods placed on the fender posts, with the small metallic slides on the saw gate by which the friction is reduced."

The foregoing claim will point out, pretty clearly, to those well acquainted with saw mills, the general arrangement adopted by the patentee, and will show that it embraces very little of novelty in either of its parts. Guides for stiffening the saws have often been placed just above the log, and made adjustable, to adapt them to stuff of different sizes. The frames have also been made to work in metallic guides, instead of against the fender posts, and, in fine, nearly all the ends proposed in the present patent have been obtained by analogous means.

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31. For an improvement in the *Construction of Mill Stones;* John Marley, city of New York, November 28.

The bed stone and runner are to be made of burr stones, but in a six foot stone, the centre of the bed stone, for a diameter of four feet, is occupied by a wheel of cast iron; the grinding part of the stone forming a rim around this, of only one foot in width. The runner is constructed in a similar manner, with a large opening in its centre, but the rim is only eleven inches in width, so that when placed upon the bed stone an annulus of the latter, an inch in width, is left uncovered by it. The grain from the hopper falls upon a conical cap which guides it on to this inch ring of lower stone, where the feeding takes place. Instead of one there are four or more spouts for the delivery of the flour.

"The advantages of said stones over the mill stones now in use,

are, *first*, they are less liable to heat the flour; *secondly*, a greater quantity may be ground in a given time and with less power.

"All I claim as my invention is the peculiar form and construction of said mill stones."

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32. For an improvement in *Fanning Mills for Cleaning Grain;* David Clinton, North Haven, New Haven county, Connecticut, November 29.

The general form of this wheat fan is the same as that most usually employed; the patentee, however, has extended his description over half a dozen pages, of which we shall give no more than the claims, which are to "the peculiar form and construction of the hopper, and of the cog and pinion wheels connected with the shaft of the fan; and also the lower shake and its appendages; the peculiar gearing to produce the double shake; the locker for the safe deposite of the sieves and grate when not in use." The said deposite for the sieves and grate is merely a box fastened on to one side of the machine.

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33. For a machine for *Cutting Sausage Meat;* Charles Otis, Greene, Franklin county, Pennsylvania, November 29.

A row of levers vibrate upon a rod, or bolt, which passes through the whole of them; these levers have knives on one end, with which the cutting is to be effected; under the other ends of them there are springs which are intended to force the knives down with a smart stroke. The levers are to be raised by means of cams, or lifters, placed upon a revolving cylinder. The claim is to "a machine constructed upon the principles, and operating in the manner described; that is, with levers, or helves, each carrying a knife, and operated upon by cams, or lifters, upon a revolving shaft.

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34. For a *Method of Heating Carriages,* and all travelling vehicles; Alexander M'Williams, M. D., Washington, District of Columbia, November 29.

The specification of this patent is altogether inadequate as a specification, seeing that it does little more than inform us what is to be done, leaving every one to invent his own method of carrying it into operation. We are told that the carriage is to be provided with flat metallic boxes, or tubes, fitted to any part within it, and that these are to be heated either by lamps, coal, wood, spirits, or other combustible; that the flame and smoke are to ascend into these boxes, from the lamps, or other articles in combustion, tubes being provided to carry the smoke off. The burning body is to be fixed somewhere on the outside. The claim is to "the *method* of heating carriages from the outside, with a lamp, or lamps, wood, coal, spirits, or any other combustible matter; and heating thereby from the bottom, top, sides, or ends, by double or single metallic boxes, or tubes, placed on the bottom, top, sides, or ends, of the carriage, connected or separate."

A specification so vaguely drawn up, does not certainly fulfil the

requirements of the law, that "in the case of any machine, he shall fully explain the principle, and several modes in which he has contemplated the application of that principle."

In the Transactions of the Society for the Encouragement of the Useful Arts, established in Paris, there is a description of a similar contrivance, of which we intend to give an abstract, in the succeeding number of this journal.

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35. For an improvement in the *Tanning of Leather;* Joseph Blunt, city of New York, November 30.

Although the specification of this patent describes a particular apparatus by which a vacuum is to be produced in a vat for tanning leather, it is not accompanied by any drawing. The patentee says that his "improvement consists in producing a vacuum in a vat in the manner above described, and the letting in the tannin, to tan the hides, while the air is thus exhausted."

The leather is put into the vat, filled with water, which is then to be so closed up as to be air tight. A pipe, or tube, descends from the bottom of the vat, the lower end of which is to dip into a vessel of water. The tube is to be thirty-two, or more, feet in length, and is to have a valve or stopcock at the bottom. A vacuum is to be produced in the vat by opening the valve at bottom, which is to permit the water to descend from the vat, through the tube, until it is counterpoised by the pressure of the atmosphere. The vacuum being thus produced in the vat, the communication between it and the tube is to be cut off, by closing a valve at its upper end, tanning liquor is then to be passed into it through a tube prepared for the purpose. "When additional pressure is required, it may be given by a force pump, or hydrostatically, by a column of the tanning liquor."

In order to carry the proposed plan into operation, it will, in general, be necessary to place the vat at the top of a high building, so that its bottom may be elevated thirty-two or more, feet above the point where the water must be discharged; this, we think, a very objectionable part of the plan, especially as the end can be attained, very readily, by the application of adequate and well known means. At p. 418 of vol. x. an extract from "Babbages Economy of Machinery," will be found, showing that the principle of tanning in a vat exhausted of air is practically applied in England. The patentee, it is presumed, was fully aware of this circumstance, as he has not claimed the mode of tanning in a vat exhausted of its air, but merely his own mode of exhausting it; a mode the adoption of which we apprehend will not be recommended by any superior convenience.

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36. For an improvement in the *Art of Turning;* Horatio Cook, city of New York, an alien, who has resided two years in the United States, November 30.

The object patented is the making the top rail and slats of chains, by turning, instead of working them by hand, out of wood sawed to the curve, or bending them out of straight stuff. The patentee says that

he turns six tops at once, by taking stuff sawed to the proper curve, and fixing them, by glue, or otherwise, so as to form a circle on the face of a wheel. The length of a top, he observes, is commonly eighteeen inches, that their curvature is a radius of three feet, and that consequently six of them will make up the circle. The term radius, we suppose, is here used instead of diameter.

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37. For an improvement in the mode of *Setting Glazier's Diamonds;* John Dickenson, city of Philadelphia, November 30.

(The specification will appear in the next number.)

SPECIFICATIONS OF AMERICAN PATENTS.

Specification of a patent for an improvement in the Saw Mill, by the application of which circular saws are made to cut laths, or other light work, on the edge, and on the side, at one operation. Granted to FRANCIS SHUMARD, *Cincinnati, Ohio, October* 31, 1832.

The log to be sawed into laths, or other strips, is first cut to the required length, and then fixed upon a saw carriage, with suitable head blocks. This carriage may be made to traverse backward and forward by any appropriate gearing; that which I commonly use, and which I prefer to any other, is the crank motion communicated from a revolving shaft by means of a pitman.

The two shafts of the circular saws run in a frame which is made to slide up and down between vertical cheeks above the log. By means of a lever, a rack and pinion, or other contrivance, the frame may be raised or lowered so as to adapt the saws to the dimensions of the log. I usually employ one saw running horizontally, and two, or more, running vertically, which latter cuts the laths, or other strips, to a proper thickness, whilst the former cuts them off at their edges.

The saws are made to cut as the log passes in either direction, thereby saving the time which would otherwise be expended in drawing the log back.

For the purpose of setting, or of moving, the log sideways, the carriage is divided into two parts, one of which runs upon suitable rails on the other. An iron shaft under the upper section of the carriage, has a pinion upon each of its ends, which operate upon racks on its lower side. A rag wheel on the head of the shaft, provided with palls, and acted on by a feed hand in the usual way, shifts the log sideways, to such a distance as shall correspond with the thickness of the laths to be cut.

At each end of the frame on which the carriage moves, there are attached blocks, or trippers, against which, at every semirevolution of the crank, the hands strike, and are lifted so as to act upon the rag wheel in the requisite degree.

By means of the drawing deposited in the patent office, and the references thereto annexed, the various parts which I have described, and their mode of action, will be readily understood.

What I claim as my own invention, and for which I ask a patent, is the causing of the saws to cut as the log traverses in either direction; the mode of moving the log sideways, as above described; the combined use of vertical and horizontal saws, cutting the sides and edges of the lath simultaneously; the mode of adjusting the saws by means of the sliding frame; and the general construction and arrangement of the apparatus by which the intended effect is produced.

FRANCIS SHUMARD.

Specification of a patent for an improvement in the Reacting Water Wheel. Granted to ROBERT EASTMAN, *Concord, Merrimack county, New Hampshire, March,* 1833.

WITH TWO COPPERPLATES.

To all whom it may concern, be it known, that I, Robert Eastman, of Concord, in the county of Merrimack, and state of New Hampshire, have invented certain improvements in the construction of the reacting water wheel, used for the driving of machinery by the reaction of water, by which improvements its action is rendered more perfect, and it is rendered self-regulating by the addition of a regulator, or governor; it is also made peculiarly compact, whilst it still affords sufficient inlet and outlet for the water to operate in the most effectual manner. And I do hereby declare, that the following is a full and exact description of my said improvements, reference being had to the drawings which accompany, and make part of, this specification.

The wheel may be made in whole, or in part, of cast iron, or other materials may be employed in its construction. It may be cast in pieces like those represented in the drawings, or the form may be variously modified, whilst the same principles are retained. Its dimensions may also be changed, and when of a very small size, the number of floats may be reduced to fewer than eight, which is the number I generally employ, as shown in the drawings. A is the shaft of the wheel, terminating below at the step on the bridge-tree O, which is capable of being raised or lowered by means of a suitable rod, or rods, as shown at S. When eight floats are used, four of them are stationary, and four are moveable, and it is by means of the latter that the quantity of water to be expended is regulated. D represents the top rim of the wheel, which has a projecting fillet, *d*, cast on it, which is made to fit exactly in the opening of the cistern piece or plate, C. A similar rim is made for the under side of the wheel, but, on this, I usually place the fillet on the outer edge. These rims are to be attached to the stationary floats by means of screws,

or rivets. On the flooring piece C, the stationary floats, which may be cast in one piece with it, are shown by black lines, whilst the dotted lines represent the moveable floats, alternating with the former, and by their motion enlarging or diminishing the aperture at each of their ends. They are supported by bolts passing through them edgewise, and through the upper and lower rims. The plate F, having upon it the jointed arms, or connecting rods *a*, *a*, *a*, *a*, is intended to act on the moveable floats, in doing which it receives its motion from a regulator, or governor, to be presently described. A side and edge view of one of the moveable floats is given at E E, with the slot which admits of its being drawn by the connecting rods nearer to the shaft A. C C are cistern plates, which rest upon ledges *c*, *c*, *c*, *c*. These ledges are also shown in the section R. B is a centre-piece, which I employ to connect the wheel to the shaft. T T are the bolts which connect and support the cistern pieces.

The regulator, or governor, acts upon the same principle with those used for steam engines and other machinery, and is only so modified as to adapt it to the purpose to which I apply it. U U are the centrifugal balls, the jointed arms, N, of which act upon the sliding collar L. There are two wheels, M M, which I call the upper and lower blank wheels. In the upper blank wheel the collar L turns freely, whilst it is so connected with it by means of a ring and set screw, as to cause the two to raise and lower together. The two blank wheels are connected by the two bolts *n n*, and two pins rising from the plank V, and passing through the ears *e e*, serve to guide them steadily. The axis of the vertical blank wheel P, passes through the shaft A, and has, on each side of the shaft, an endless screw, K. These endless screws take into wheels H H, placed upon the rods I I, for the purpose of causing them to revolve. When the centrifugal force is much increased, the regulator will bring the lower wheel, M, into contact with P, and when sufficiently decreased, will bring the upper wheel, M, in contact with it, when the wheels H will be turned, and the pinions J J, on the lower ends of the rods I I, taking into the teeth in the openings in the plate F, and causing it to turn, will open or close the moveable floats. At a medium speed, neither of the wheels M M will be in contact with P.

The regulator may, if preferred, be detached from the shaft, and carried by a band or otherwise, and be geared so as to operate on the rods I I; it may also be dispensed with entirely, and the wheel P, or some appendage operating in the same way, may be turned by hand, so as to set the floats in any required position.

The cistern pieces C C, I prefer to make of wood, as they produce less friction than iron, when accidentally brought into too close contact with the wheel; and they are also, when worn, more readily and economically adjusted than if made of metal. As the water is admitted both above and below the wheel, its pressure is equalised, so that the weight of the column is not felt on the step. The two orifices likewise tend to give a full and equable supply of water to the wheel.

What I claim as my invention, and for which I ask a patent, is the making the floats of a reaction wheel adjustible, as herein described.

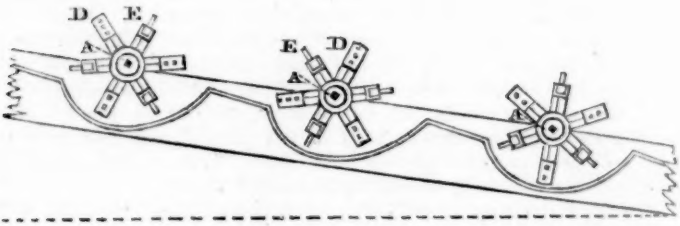
I also claim the application of the regulator or governor, to render them self adjusting. Likewise the manner of adjusting them by hand, enabling the operator to do so without the necessity of descending to the wheel, or in any way disturbing the arrangement of the apparatus. In effecting these objects, I do not intend to confine myself to the precise mode which is herein set forth, but to adopt any other which operates upon the same principle, and produces a similar result.

ROBERT EASTMAN.

Specification of a patent for a machine for washing Gold and other Ores. Granted to WILLIAM DAVIS, *late of Great Britain, but now of Fauquier county, Virginia; he having declared his intention to become a citizen of the United States. November* 22, 1832.*

To all whom it may concern, be it known, that I, William Davis, have invented a machine for washing gold and other ores, and that the following is a full and exact description thereof.

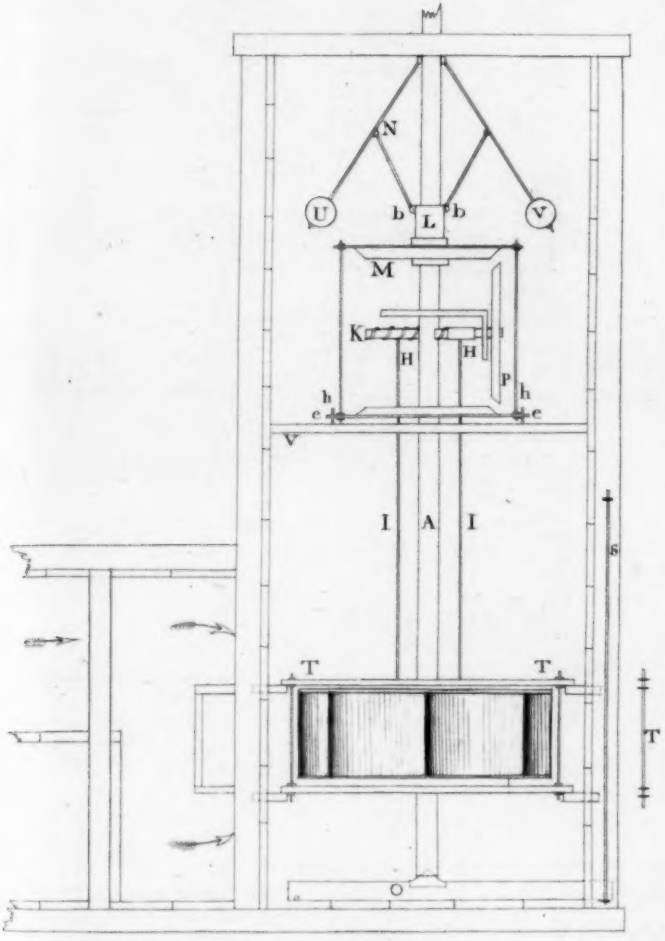
I make any number of revolving reels, so formed as to carry dashers, or agitators, and rakes, which are to operate upon the ore or other matter containing metal; these reels revolve in a succession of curvelinear troughs, or concaves, constructed upon the principle exemplified in the annexed drawing.



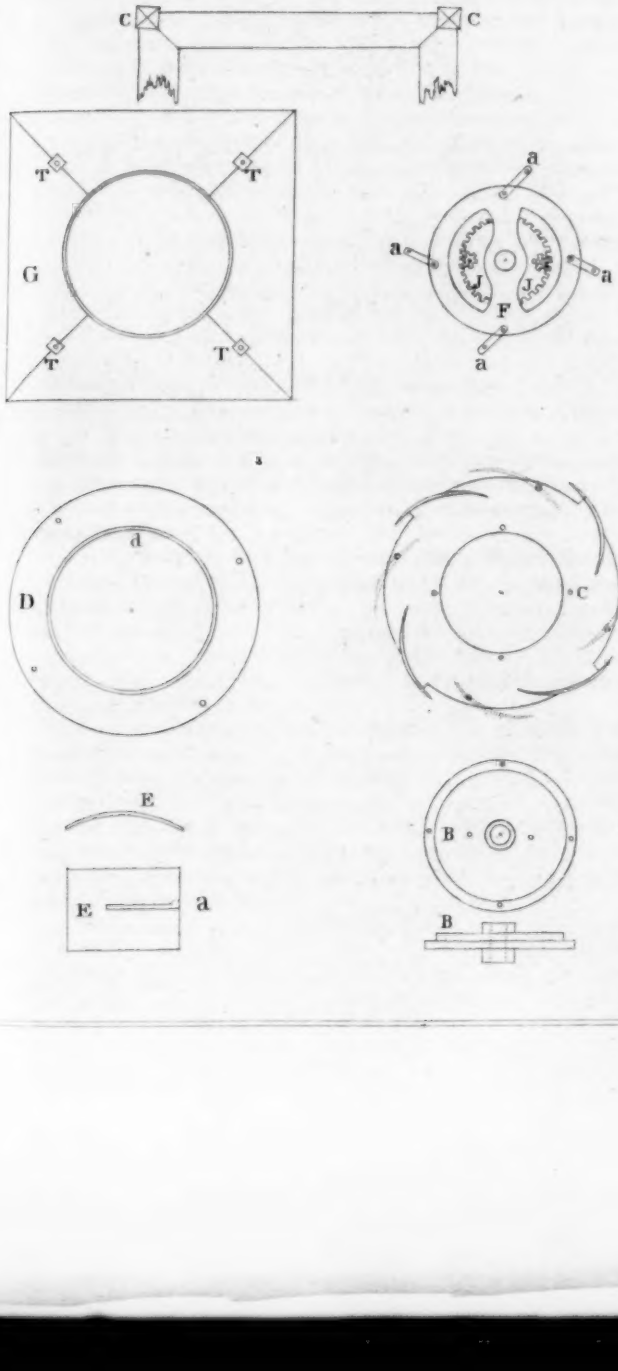
A A A are the shafts of the revolving cylinders, or reels, carried round by means of bands working upon whirls, or by bevel gearing, or in any of the ways in which such motion is ordinarily communicated. The said reels are provided with any number of sets of arms, to carry the dashers, and rakes; most commonly, however, I employ six sets of arms, three of them furnished with dashers without rakes, and three with teeth, forming rakes. D D shows the longitudinal dashers without rakes, and E E the dashers with rakes. These cy-

* As we have not thought it necessary to give any more than a sectional drawing of the reels, or beaters, those parts of the specification which refer to drawings of the other parts, have been omitted.

R. EASTMAN'S REACTION WHEEL.



R. EASTMAN'S REACTION WHEEL.



linders may be made of any convenient length and diameter, but in a machine which I have found to answer well, they are four feet six inches long, and eighteen or twenty inches in diameter, from point to point of the rake teeth.

In giving motion to the reels, their velocities are graduated in such way as is found to produce the best effect, which will differ according to the nature of the ore; in all cases, however, the gearing is so managed that the upper, or first reel, has the greatest velocity, the velocities gradually diminishing until that of the lower is such as not to throw the finer particles of metal from the trough. The mechanical action of the reels is such as to deliver the earthy particles from one trough to the other, until they finally flow off at the lower end. In many instances I find it of advantage to supply all the dashers of the upper reel with teeth, forming them into rakes, as this serves the purpose of dividing, or comminuting, the material to be washed, which prepares it more perfectly for the action of the other reels.

Most commonly I employ three transverse reels only, and increase them to five, or such other number as may be found best adapted to the kind of ore, or other substance, to be operated upon. The whole machine forms an inclined plane, from the feeding to the lower end, as shown in the section.

The concaves, or hollow troughs, although curved, are not usually made segments of circles, or if so made, the circle is of considerably larger radius than the semidiameter of the rakes, as the points of these are to come nearly into contact with the bottom of the troughs, but enter and leave them at such a distance as shall allow for feeding, and prevent the improper dashing over of the material which is being operated upon.

A feeding board, or hopper, is used, from which the material to be washed may be supplied, and upon which the required water may be allowed to run; there is nothing peculiar, or novel, however, in this part of the apparatus, and, therefore, it does not require to be described; nor is it necessary to specify the frame work of the machinery, as every competent workman will be able to construct this, in such way as he may prefer.

What I claim as new, and for which I ask a patent, is the employment of a machine for washing gold and other ores, which machine has revolving reels, or cylinders, carrying dashers, a part of which are furnished with projecting pieces, or teeth, which come nearly into contact with the lower side of a trough, or concave, within which they revolve; whether the same be made in the exact manner herein described, or in any other operating upon the same principle, and producing a similar effect.

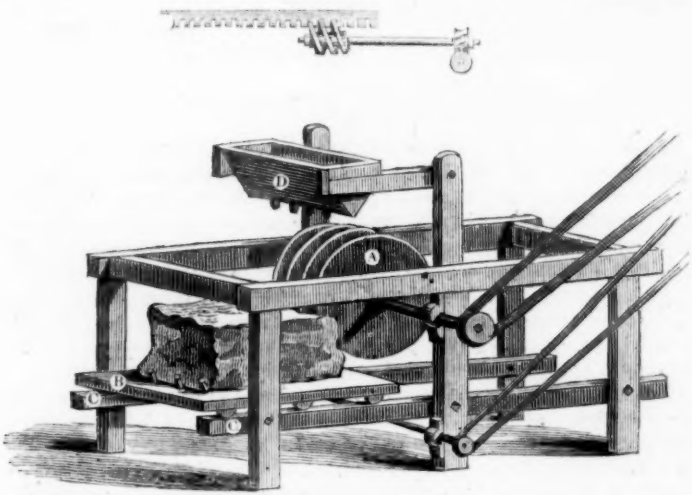
WILLIAM DAVIS.

Specification of a patent for an improvement in the method of Sawing Marble, and other stone, and cutting or working mouldings, or groovings, thereon, and polishing the same. Granted to ISAAC D. KIRK, *city of Philadelphia; first issued July* 3, 1832. *Patent surrendered, and reissued on an amended specification, December* 28, 1832.

To all to whom these presents shall come, be it known, that I, Isaac D. Kirk, of the city of Philadelphia, and state of Pennsylvania, have invented a new and useful improvement in the method of sawing marble and other stone, and cutting, or working, mouldings, or groovings, thereon, and polishing the same; the sawing being performed by means of an improved revolving, circular, metallic plate, smooth, or without teeth, upon the face, or edge, operating by friction with sand and water upon the material to be cut; and the moulding, or grooving, and polishing, being effected by means of the improved revolving moulding and polishing cylinder, or wheel, operating in cutting mouldings by friction with sand and water upon the surface to be wrought; and in polishing by friction, in like manner, with putty, buff, pumice-stone, or some other suitable material; viz. one or more circular metallic plates, smooth or not serrated upon the face, or cutting edge, (copper, or soft iron are deemed preferable,) are securely fixed, vertically, upon a horizontal shaft, or spindle, of iron, of any required dimensions, passing through the centre of the plate, or plates, and supported at each end by a proper frame of wood, or of cast iron, upon which the shaft works. On one end of the shaft is a cog wheel to connect it to the moving power.

Where two or more plates are used on the same shaft, they are secured at the proper distance from, and parallel to, each other, by circular metallic bands of a thickness adapted to the intended thickness of the slab, or slabs, to be cut; which bands are fitted upon and around the shaft between the plates, or saws. Under the shaft, at the distance of a little more than the radius of the plates, or saws, is a carriage on friction rollers, or wheels, resting on a permanent railway, to support and carry forward the stone, or marble, to the plates, or saws; it is moved either by a rack and pinion, or by weights and pulleys. Over the saws is fixed a hopper, filled with sand and water, which is carried by a conductor leading from an aperture in its bottom, to the saws at the point of their contact with the stone or marble. The plates, or saws, may be made of any required dimensions, and must be wrought to a uniform thickness throughout, with the cutting edge smooth, or not serrated, and either rounded, beveled or flat. The improved moulding and polishing cylinder, or wheel, is of any metal, (cast iron is preferable for moulding, and some of the softer metals, and wood, for polishing,) and of any requisite dimensions, having the converse of the intended moulding, or grooving, either cast or turned upon its surface, or periphery, by means of which any series of mouldings, or groovings, can be wrought on a

. Kirk's machine for Sawing, Moulding, and Polishing Marble.



A. The saws, or the moulding cylinder of soft cast iron.
B. Carriage to support and carry forward the marble, or stone.
C C. Rails on which the carriage travels.
D. Hopper for sand and water.
E. Apparatus for advancing the carriage.

surface of marble, or stone, at one operation, and in like manner be polished. It is fixed upon a horizontal shaft passing through its axis, which is turned by a cog wheel connecting it to the power, and operates on the material to be wrought, by revolving vertically against its surface in contact with sand and water in cutting mouldings, and in contact with pumice-stone, buff, putty, or some other suitable material in polishing. A cylinder, having a regular smooth surface, is used in like manner for flatting, and for polishing a plain surface. The marble, or stone, is carried forward, and under the moulding and polishing cylinders by a mechanical arrangement similar to that before described.

The polishing cylinder is similar in form to the above, and used in like manner with polishing powder, as putty, buff, &c. instead of sand, and is made of wood, or some of the softer metals.

The improvement claimed by said Isaac D. Kirk, consists in the sawing of marble, or other stone, by means of a revolving, circular, metallic plate, smooth, or not serrated, on the face, or edge, and applied with sand and water, as is done with the straight saw; and also in making, or forming upon the surface, or periphery, of a metallic, or wooden cylinder, or wheel, the converse of the intended moulding, or grooving; by means of which, a series of mouldings, or grooves,

can be wrought on a surface of marble, or stone, at one operation, with sand and water. And in like manner, polished with putty, buff, pumice-stone, or other polishing material.

ISAAC D. KIRK.

Remarks by the Editor.

From the information which we have received relating to the above described machine, its invention appears likely to mark an important epoch in the art of working marble; this information has been derived from a gentleman of much intelligence, residing in Philadelphia, who relates only what he himself witnessed, as regards the operation of the machinery, and which we will give in his own words.

"I embrace," he says, "this opportunity of stating what I have seen of the practical operation of the experimental machinery erected here by the patentee; which, I will observe, was of very rude construction, and capable of great improvement in its application on a more extended scale. The saw used in these experiments was a circular copper plate of thirty-one inches in diameter, attached to a shaft working horizontally on a slight frame of wood, and turned by means of a band and whirl. I have seen this saw, worked by the power of *one man*, cut through a block of our hardest marble, one foot in length and depth, or one foot square, in thirty minutes; and with increased power I doubt not it might be done in much less time.

"I also, at the same time, saw the moulding wheel, of cast iron, work out mouldings on a slab of marble one foot in length, in one minute and a half, and have no doubt that the same could be done more rapidly with machinery less rudely constructed.

"The marble is left by the saw, as well as by the moulding wheel, or cylinder, in a state fit for polishing, without any preparatory chiselling, or rubbing down with sand; and the polishing is performed in the same manner as the moulding, and with equal or greater rapidity."

We are informed that in the sawing of large blocks of marble in the ordinary way, from six to eight square feet is accounted a good day's work; but that in the cutting of small blocks, a workman can rarely cut more than two or three feet. From the experiment above recited, it appears fair to conclude that ten times as much can be effected by Kirk's machinery, when operating on small blocks, and probably upon any which are not too large for the circular saw. This also, it may be observed, is not limited in its diameter by the same cause which limits those made of a single plate far sawing timber, namely, the expansion by heat, which causes the saw to buckle, an effect which will be prevented in the cutting of stone by the saw being kept constantly wet. The cost of a saw will be saved in the work performed by it in one or two days.

The letter from which we have quoted does not mention the width of the mouldings wrought by the revolving moulding wheel, but it appears likely that the saving of time in this usually slow operation, will much exceed that effected in sawing.

We perceive by the records of the patent office, that Mr. Kirk has assigned his right to Mr. Richard S. Risley, of Philadelphia.

¶ TRANSLATIONS FROM FOREIGN JOURNALS.

On the art of Glass Blowing. By Lafonde.

(Concluded from p. 259.)

To form a Lip.

3. To form a lip upon the end of a tube, or in other words to turn the edges over, it must first be cut and the edge rounded as already described in the two preceding operations; when it has been so far widened that the sides are bent outwards about forty degrees, the operation is completed by the aid of the instrument figured in the annexed cut, (fig. 5.) This instrument is made of a flat piece of iron, half an inch broad, six or seven inches long, and half a line thick; it has a handle *d e*; the bend *a b*, is about an inch and a half in length, and makes an angle of about ten degrees with *a e*. When the widened end of the tube has been softened, the instrument is applied to the rim, the part *a b* being placed at right angles to the axis of the tube. In order to this, it is held by the extended fingers of the right hand, the elbow being at a short distance from the body, in order to hold the tool more steadily; it is then passed over the edge, pressing it lightly as the tool is carried over it, until the desired effect is attained.

To taper a Tube at the end.

4. This is an important operation from its connexion with many others, the success of which depends on the skilful performance of this operation. The method of executing it is as follows:—take the tube in the left hand, as has been described in the process of edging, (paragraph 1.)

Hold the tube firmly in its position, in the right hand, the palm turned upwards, and the fore fingers close together, and raised almost perpendicularly so as to form a plane against which the thumb is applied, in order to turn the tube about its axis.

For the complete success of this operation, it is indispensable that both hands should exactly concur in the motion of the tube, so that this motion may be perfectly regular, and always in the same direction. When the tube becomes softened, if one of the ends were turned faster than the other, it would twist, would become obstructed, and thus cause the failure of the operation.

The tube, being held in the manner just mentioned, is placed in the flame of the large jet, and kept there until it is completly softened; it is then removed from the flame, and brought between the operator and the cap. The left hand remaining fixed, the right is removed

from it so as to produce a taper of about six or seven inches long. Care must be taken to continue turning the tube as if it were in the flame, to prevent its cracking or flying.

The principal merit of this operation consists in the taper being duly centered, that is, in its axis being identical with that of the tube.

Sealing, or Closing.

5. There are four forms which may be given to the sealed end of a tube.

1. *Conical sealing.*—This is produced by first tapering a tube at the place where it is to be thus sealed; the taper is next heated by the small jet, at a point the position of which depends upon the greater or less elongation of the required taper; the part to be separated is at the same time gently drawn off with the right hand until it separates.

2. *Spherical Sealing.*—After the tube is tapered, the taper is to be rendered more obtuse by heating the extremity; this produces at the tip a button of glass, which is heated in the small jet, turning the tube with the left hand, while in the right is held a capillary tube, the extremity of which is held in the flame.

As soon as the button begins to fuse, the heated end of the capillary tube is touched to it, and with a sudden slight jerk in the direction of the flame, the button is quickly taken off. The capillary tube being immediately struck lightly upon the table, the small lump of glass which adheres to it flies off, and the tube may be applied to detach a second button. This process is continued until the cone has been rendered so obtuse that the button at the extremity becomes imperceptible.

The tube is next to be transferred to the right hand, and the entire end heated in the large jet, the tube being turned between the fingers. When the sealed end becomes red hot, the operator blows gently into the open end, so as to form a ball upon the heated end.

3. *Flat sealing.*—This is formed from the spherical sealing just described, by heating in the large jet, and flattening the end gradually by the aid of the instrument, fig. 5.

4. *Indented sealing.*—This is formed from the preceding by heating the end of the tube red hot, and then exhausting by drawing in the breath, thus producing a re-entering cone.

To obstruct a Tube at any point.

6. This operation is performed by holding the tube in the flame, in the position described in the method of tapering, turning the tube until the bore is entirely closed.

To join a Pedicle.

7. A solid pedicle is obtained by tapering the obstructed portion of a tube of any convenient size.

In order to join the pedicle to the end of a tube, terminate the latter by a conical sealing: solder to the button at the extremity of the cone a drop of glass, to which unite the pedicle; the last two operations are performed with the smaller jet.

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This pedicle may be formed into a hook of any desired shape, by the use of a small wire tool, (see fig. 6,) which may also be used to separate the wicks of the lamp.

To make a ring, the end of the pedicle is first fused in the slender jet, into a ball, to which a second pedicle is soldered, this being turned up by the tool, the end is joined to the tube at a point opposite to the juncture of the first pedicle. A finish is given to the two junctures, and the ring is complete.

Should it not have the desired shape, it must be heated in the large jet, and as it fuses, the diameter will lessen; the circular form may then be given to it by the hook.

To narrow the Bore of a Tube.

8. It is often necessary to diminish the bore of a tube in certain parts. There are two methods of doing this. In the first the tube to be narrowed is managed as described in number 6, the operation being stopped as soon as the diameter is sufficiently reduced; the external diameter tends to decrease as the internal diameter is lessened, the sides increasing in thickness; this must be prevented by gradually bringing the hands nearer to each other, the operator being guided by the effect produced.

The second method proceeds, at first, as just described; but instead of preventing the slight taper which results from the narrowing of the tube, it must be made more considerable by carrying the right hand a short distance from the left. When the tube is sufficiently narrowed the operation is reversed until no external contraction appears.

By this method, which is more difficult in practice, a more perfect contraction is obtained than by the former. The narrowing of the tube is more regular, the flare each way from the narrowest ring is more nearly conical, and more elongated, great advantages when a cone of cork or metal is to be fitted in the cavity to serve as a valve, as, for instance, in the pump which we shall hereafter describe.

To form a projecting Ring upon a Tube.

9. This operation, which is principally used for double joining, is performed by heating, in the slender jet, that part of the tube at which the projection is to be made. As soon as the glass softens it must be pressed together with both hands, turning the tube constantly; the sides are forced outwards, forming the projection, the planes and the sides of which ought to be perpendicular to the axis of the tube.

To succeed in this operation it is necessary to proceed slowly, and not to endeavour to obtain the desired effect, at one heating. Care should be taken that the two ends of the tube are kept in the same direction

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To Pierce a Tube.

10. A tube may be pierced either in or out of the flame.

To pierce a tube in the flame, an operation only necessary when a small opening is required, the part to be pierced is held in the flame of the slender jet, so that it may play perpendicularly upon the tube. One of the ends of the tube being stopped, the breath is blown in at the other, and the tube is instantly pierced.

If a larger opening is required, the tube is placed as just stated, and when the point to be pierced is fused, the open extremity is brought to the mouth; the tube being then removed from the flame, the heated part swells out by the pressure of the breath; this cone is again exposed to the flame and is flattened until the flattened surface is somewhat less in diameter than the required opening; the impulse of the breath is then increased so as to make this part swell out into a ball, which if possible should not be suffered to burst. The thin part of the protuberance is cut off by a file, and the edging is finished in the large jet.

To Join Tubes.

11. We next proceed to treat of the various ways in which tubes are joined together, and of the modes of joining.

1. To solder together two tubes of equal diameter, the end of one of them, opposite to that which is to be soldered, is first stopped; the two ends, to be joined, are next widened by the process described in No. 2; they are then applied to each other and held in the large jet, turning them round all the while, that the whole circumference of their edges may be heated as equally as possible. After the two ends thus joined have remained for a moment in the flame, the operator blows through the open end, which should be placed on the right hand. This process of heating and blowing is repeated until the soldering is perfectly done, but care must be taken in blowing, that a very slight swelling is produced. When the joining is completed, this swelling is made use of to bring the tube to as uniform a diameter as practicable. To accomplish this, the operator exposes the most prominent parts to the flame, at the same time gently drawing the ends of the tube in opposite directions.

2. When a tube is to be joined perpendicularly to another, the tube is pierced according to the process No. 10, and having one of its ends stopped, is heated in the large jet, being held by the left hand a little above the flame, with the pierced aperture upwards and the open extremity towards the right, that it may be more conveni-

ently blown into. The tube which is to be joined to it, is held in the right hand, and turned between the fingers, perpendicularly over the point where they are to be joined.

After the tubes are sufficiently heated, the perpendicular tube is applied to the opening; the open end of the same tube is carried to the mouth to blow into it, the end of the horizontal tube opposite to point of juncture having previously been stopped. The vertices of the two right angles, formed by the soldering, are then alternately heated, and at each heating the operator blows gently into the tube. After the two angular points are perfectly joined, the soldering of the other parts may be effected in a similar manner.

The joinings are then annealed by removing them gradually from the flame.

3. It may happen that a tube is to be joined to another of a greater diameter, so that a portion of the smaller tube may be inserted in the larger. To effect this, the extent to which the small tube is to be introduced, being determined, a projection is formed on it, as directed in the process No. 9. The large tube is tapered at the two ends, which are closed by a conical sealing; this cone is rendered obtuse as already described, and an opening is made in the sealing by the method, given in No. 11, for piercing a tube. The aperture having been edged, the tube is introduced; the other end being closed, as already stated. The juncture is then applied to the large jet and finished as usual, by alternately heating and blowing into the tube.

In all the varieties of soldering, care must be taken that the points where the two tubes meet, project rather than form a groove, since in this latter case the joint would be more liable to break.

To Bend a Tube.

12. The most certain way to bend a tube properly, is to heat in succession the part intended to form the convex side, and that which is to form the concave side of the flexure. The other two sides are thus indirectly heated. All the portions of a proper flexure are perfectly uniform, without depressions on its convex, or wrinkles on its concave side; and all its corresponding points are contained in the same plane.

To attain these ends, if the tube is straight, it should be tapered at one end, and the tapered part be bent at right angles to the tube, and in the plane of the required flexure. The tube is then heated on the side which is to form the re-entering angle, and towards the bent end of the tube; a slight force is then exerted in the direction in which the flexure is to be made, and as soon as the heated portion begins to yield, the part next further from the bent end is heated, and so on until the flexure is completed.

To Blow a Bulb.

13. To blow a bulb, procure a tube of a thickness proportionate to

the size of the bulb required. Suppose the tube tapered at two points near to each other; two different cases may then occur; it may be required to blow a bulb at the extremity of one of the tapering parts, or between two of them.

In the first case the taper is changed into a conical sealing (No. 5,) and this latter into a spherical sealing. This being done, the whole tube is heated, turning it constantly between the fingers; when it is red hot, the open end of the tube is immediately applied to the mouth, and a bulb of the required size blown, the tube being still kept in rotation.

To blow a bulb between two tapers, stop one of the ends and heat the tube at the points where the bulb is to be blown, holding it in the position for tapering, described in No. 4. When sufficiently heated, withdraw it from the flame by a motion of the right hand, which is drawn near the body of the operator, and apply the lips to the open end of the tube without moving the left hand. The tube must be turned as long as the blowing is continued, that motion contributing to the regularity of the sphere, which should be so formed that the axes of the two portions of the tube may be the prolongation of the same diameter.

Every operation which is described as performed on the end of a taper, or between two tapered portions of a tube, may be also performed at the end of a tube, or at any point between the ends. To perform this, the large tube which is to produce the bulb, is joined on and tapered, the taper changed into a conical sealing, which is afterwards edged down.

Funnels.

14. To form a funnel, such as is at the top of a Welter's tube, first blow a bulb; holding this bulb in the right hand by the taper, expose it to the flame so that by the effect of the heat the part opposite to the taper may become flat, and form a plane surface at right angles to the axis of the tube. By now blowing strongly into the tube, the bulb swells out, and the thin sides of the protuberance are cut off by a file at about half an inch from the bulb itself. One end of a capillary tube held in the right hand, is then heated in the smaller jet, the left hand holding the bulb, already described, by the taper, and the remaining part of the protuberance is taken off by heating it in the slender jet, at a distance sufficient to form an edging. The capillary tube being in a state of fusion at the end, serves to remove the overplus glass which may be readily made to adhere, in consequence of its thinness.

To construct a funnel, such as is used in filtering, the conical form should be given to the bulb before it is burst, as far as may be practicable.

The operator heats it in parts, and makes the swell greater as the distance from the tube increases; after it has burst the cone is finish-

ed by the same process, and with the same instrument, as was used in widening.

Having now terminated the statement of the methods of construction of the parts most generally used in forming apparatus, we will proceed to point out the methods of making certain common articles.

Welter's Safety Tubes.

To make one of these tubes, cut from a tube any length, at pleasure, to form the first vertical branch. To the end of this branch join a portion of a larger tube tapered at two points; after which, cut off the taper on the end opposite to the joint, the use of which was to effect the juncture, and replace it by a spherical sealing.

Blow a bulb upon the portion of tube thus joined, (No. 13,) and make a funnel of the bulb, (No. 14.) A second portion of a large tube, similar to the first, is joined to the opposite end of the tube; then a short tube of the kind which forms the vertical branch just refered to is joined to the latter. The large tube is thus placed between two others of equal diameter; it is then blown into a bulb, as described in the second process of No. 13.

A horizontal tube, stopped at one end, is then pierced at the proper place, and the vertical tube is soldered to it, (No. 11,) the end terminated by the funnel having been, previously, stopped by a cork. The proper flexures are then made, beginning with the bending of the vertical tube.

Dropping Tubes.

To make a dropping tube, a large tube is soldered between two smaller ones. From the large tube is then blown a bulb, and one of the small tubes is tapered to the requisite thickness, after a lip has been made on the end of the other. The tube is then bent into a convenient form.

Whenever a permanent taper is formed, the sides of the tube should be allowed to thicken, thus rendering those of the taper stronger.

Capsule.

To experiment upon minute portions of matter, the chemist often requires small vessels, such as capsules, the methods of making which we now proceed to give. First, construct a funnel, and taper the end,

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by means of the instrument represented at fig. 7, and which is composed of three small metallic rods fixed on a handle, the distance of the rods from each other being regulated by a sliding ring. Take hold of the funnel at the open side, and close the rods upon it by means of the slider; the button may thus be taken off completely, and the bottom of the capsule flattened by the use of the instrument, fig. 5.

If the capsule is properly formed, no trace of the button

should remain; the bottom should be quite flat, and the edges perfectly regular.

A bulb between two tapered portions of a tube, one of which is obstructed as already described, having been first heated on one side, then burst and edged like a funnel, will furnish a very convenient spoon for purposes of analysis. The obstructed part forms the handle, and the other, when suitably curved, serves as a beak, which is convenient in decanting.

We will conclude by describing the method of constructing a forcing pump with an air vessel.

Take a tube of about an inch in diameter and four inches in length, taper it at one end, edging it at the other, and join the tapered end to another tube three lines in diameter, and of any convenient length.

Pierce the large tube near the joining, and solder to it a tube three inches long, which has been carefully narrowed; bend the latter so that the part containing the contraction shall have its axis parallel to that of the former.

The body of the pump is thus finished: the air vessel is then constructed with a tube of the same diameter and length, within which is placed a smaller tube, soldered at the upper end, where it passes through the large tube. This soldering should be carefully executed, and the small tube kept exactly in the middle of the large one. This may be effected by edging the small tube and fixing it by temporary supports in the required place; after this operation is completed, three small pedicles of glass being substituted for the temporary supports, will keep the tube in place. The small tube is then tapered, leaving only a small aperture for the escape of water through it. On the lower end of the pump is fixed a valve, consisting of a cork cone greased with tallow, weighted with a bit of lead, and kept in its place by a brass wire.

In the contraction already spoken of, is placed another cone, which is prevented from moving too far by two cross threads, kept in their place by the cork which unites the air vessel to the body of the pump.

The piston is made as follows:—On a short tube of a convenient diameter, and tapered at two points, form two projections, about a line apart. Solder one of the tapering parts to a capillary tube, and remove the other. Between the two projections introduce a round piece of cork, having a hole to allow it to receive the tube which is between the projections. Slit the cork on one side, and after it has been placed divide it with a razor, or sharp knife, into two circular planes, which are moved round upon each other until the slits break joints with each other. The edges of the projections being ground so as to fit the body of the pump, and covered with grease, the apparatus is finished.

Notice regarding the Asphaltum or Pitch Lake of Trinidad. By Captain J. E. ALEXANDER, *42nd Royal Highlanders, F. R. G. S. M. R. A. S., &c. Communicated by the Author.*

One of the greatest natural curiosities in this part of the world, is the lake of asphaltum or pitch in Trinidad, situated about thirty-six miles to the southward of Port of Spain. The western shore of the island, for about twenty miles, is quite flat, and richly wooded, and though only one or two houses are perceptible from the sea, the interior is well cultivated, and several small rivers, which empty themselves into the Gulf of Paria, afford great facilities for the transport of sugar to the ships which anchor off their embouchures. As Naparima is approached, and the singular mountain (at the foot of which San Fernandes is situated,) is plainly distinguished, then the shore assumes a more smiling aspect; here one sees a noble forest, there a sheet of bright green, points out a cane-field—cocoa nut and palm trees are sprinkled over the landscape, and gently wave their feathered foliage; now and then a well built house appears close to the water's edge, with a verdant lawn extending from it to the sea, and the ground sometimes broken into sinuosities, and then slightly undulating. The beauty of this part of Trinidad is very great, though, from some undrained swamp, poisonous malaria exhale.

At Point La Braye are seen masses of pitch, which look like black rocks among the foliage; they also advance into the sea. At the small hamlet of La Braye, a considerable extent of coast is covered with pitch, which runs a long way out to sea, and forms a bank under water. The pitch lake is situated on the side of a hill, eighty feet above the level of the sea, from which it is distant three quarters of a mile; a gradual ascent leads to it, which is covered with pitch in a hardened state, and trees and vegetation flourish upon it.

The road leading to the lake runs through a wood, and on emerging from it, the spectator stands on the borders of what at first glance appears to be a lake containing many wooded islets, but which, on a second examination, proves to be a sheet of asphaltum, intersected throughout by crevices three or four feet deep and full of water. The pitch at the sides of the lake is perfectly hard and cold, but as one walks towards the middle with the shoes off, in order to wade through the water, the heat gradually increases, the pitch becomes softer and softer, until at last it is seen boiling up in a liquid state, and the soles of the feet become offensively warm. The air is then strongly impregnated with bitumen and sulphur, and as one moves along, the impression of the feet remains on the surface of the pitch.

During the rainy season, it is possible to walk over the whole lake, nearly, but in the hot season a great part is not to be approached. Although several attempts have been made to ascertain the depth of the pitch, no bottom has ever been found. The lake is about a mile and a half in circumference; and not the least extraordinary circumstance is, that it should contain eight or ten small islands, on which trees are growing close to the boiling pitch.

In standing still for some time on the lake near the centre, the surface gradually sinks till it forms a great bowl, as it were; and when the shoulders are level with the general surface of the lake, it is high time to get out. Some time ago a ship of war landed casks to fill with the pitch, for the purpose of transporting it to England: the casks were rolled on the lake, and the men commenced filling, but a piratical looking craft appearing in the offing, the frigate and all hands went in chase; on returning to the lake, all the casks had sunk and disappeared.

The flow of pitch from the lake has been immense, the whole country round, except near the Bay of Grapo, (which is protected by a hill,) being covered with it; and it seems singular that no eruption has taken place within the memory of man, although the principle of motion still exists in the centre of the lake. The appearance of the pitch which has hardened, is as if the whole surface had boiled up into large bubbles, and then suddenly cooled; but where the asphaltum is still liquid, the surface is perfectly smooth.

Many experiments have been made, for the purpose of ascertaining whether the pitch could be applied to any useful purpose. Admiral Cochrane, who is possessed of the enterprising and speculative genius of his family, sent two ship loads of it to England; but after a variety of experiments, it was ascertained that, in order to render the asphaltum fit for use, it was necessary to mix such a quantity of oil with it, that the expense of the oil alone would more than exceed the price of pitch in England. A second attempt was made by a company, styled the Pitch Company, who sent out an agent from England; but finding that Admiral Cochrane had failed, and being convinced that any further attempt would be useless, he let the matter drop.

Forty miles to the southward of the Pitch Lake is Point du Cac, which forms the south-west extremity of the island, and on one side of the Boca del Sierpe. On this cape is another natural curiosity which is well worth seeing, although the distance from Port of Spain renders it rather a difficult operation to proceed thither. What renders this point so interesting to the stranger is an assemblage of mud volcanoes, of which the largest may be about 150 feet in diameter: they are situated in a plain, and are not more than four feet elevated above the surface of the ground, but within the mouths of the craters boiling mud is constantly bubbling up. At times the old craters cease to act, but when that is the case new ones invariably appear in the vicinity. The mud is fathomless, yet does not overflow, but remains within the circumference of the crater. From what I recollect of the Crimea, I should say that there is a remarkable similarity between it and Trinidad;—geologically speaking, in both there are mud volcanoes, in both there are bituminous lakes, and both have been frequently visited with earthquakes.

Berwick Barracks, September, 1832.

[*New Edinburgh Philos. Mag.*

¶ *Selections from Lectures on Pottery, delivered before the Royal Institution, London, by* A. Aikins, F. L. S. F. G. S.

(Concluded from page 264.)

Of the European manufactories of porcelain, that established at Miessen, near Dresden, by Augustus, Elector of Saxony and King of Poland, in the early part of the seventeenth century, was the first that aspired to a competition with the Chinese. In compactness of texture and infusibility, it was reckoned perfect a hundred years ago. It is not quite so white as some of the French and English porcelains, but is inferior to none in its painting, gilding, and other decorations. The figures in white biscuit of this ware now before you, belong to a friend of mine who procured them at Dresden; and the other specimens form part of a set presented to your Secretary by the King of Saxony.

The French royal manufactory at Sevrès, near Paris, has been for several years in a gradually advancing state, with regard to whiteness, compactness, and infusibility of the body, the elegance of the forms, the brilliancy of the colours, the elaborateness of the drawing, and the superb enrichments of the gilding. The private manufactories of porcelain in France, imitate and approach more or less near to the royal establishment.

The porcelain clay used at present in all the English works is obtained in Cornwall, by pounding and washing over the gray disintegrated granite which occurs in several parts of that county: by this means the quartz and mica are got rid of, and the clay resulting from the decomposition of the felspar is procured in the form of a white, somewhat gritty powder. This clay is not fusible by the highest heat of our furnaces, though the felspar, from the decomposition of which it is derived, forms a spongy, milk-white, glass, or enamel at a low white heat. But felspar, when decomposed by the percolation of water, while it forms a constituent of granite, loses the potash, which is one of its ingredients, to the amount of about fifteen per cent. and with it the fusibility that this latter substance imparts.

The silicious ingredient is calcined flint; and in some of the porcelain works, (particularly, I believe, those at Worcester,) the soapstone from the Lizard-point, in Cornwall, is employed. These are all the avowed materials; but there is little doubt that the alkalies, or alkaline earths, either pure, or in combination, are also used, in order to dispose the other ingredients to assume that state of semifusion characteristic of porcelain.

The grinding and due mixture of the ingredients, in order to obtain a mass sufficiently plastic; the forming this mass on the wheel; the subsequent drying of the ware; the first firing, by which it is brought to the state of biscuit; the application of the firmer colours occasionally on the surface of the biscuit; the dipping the biscuit in the glaze; the second firing, by which the glaze is vitrified; the pencilling in of the more tender colours on the surface of the glaze;

and the third and last firing that is given to the porcelain—so nearly resemble the same processes as applied to the more elaborate kinds of earthenware, that it would be a mere anticipation of these latter if I were to describe them now.

It is not for me to determine which of our English porcelains is the best; probably, indeed, one will be found superior in hardness, another in whiteness, a third in the thinness and evenness of the glaze, a fourth in the form of the articles, a fifth in the design, and a sixth in the colours. In hardness and infusibility they are, probably, all inferior to the Dresden and to the Sevrès porcelain; for pieces in biscuit, and in white glaze, from both these manufactories, are imported in considerable quantities, in order to be painted and finished here. But it is equally certain, that the last ten years have seen the commencement, and, in part, the completion, of such improvements in this fabric, as will probably place the English porcelains on an equality with the best of the continental European ones.

Advantage has recently been taken of the semitransparency of porcelain biscuit to form it into plates, and to delineate upon it some very beautiful copies of landscapes and other drawings, by so adapting the various thicknesses of the plate as to produce, when held between the eye and the light, the effects of light and shadow in common drawings. The invention originated in the ingenuity of our French neighbours; and some very fine specimens have been sent for exhibition by Mr. Brady.

I now proceed to the last division of my subject, namely, the manufacture of those species of glazed pottery known by the general name of Staffordshire ware.

The date of this ware is about sixty years ago, and it unquestionably originated with the late Mr. Wedgewood. It not only originated with him, but was carried by his knowledge, his skill, and his perseverance, to a degree of excellence which, in several points, has never been surpassed, and in some has never been equalled. With a liberal ambition, far above the mere love of gain, his ruling object was to carry the art that he practiced to the utmost perfection of which he was capable. For this he spared neither time, nor labour, nor expense; and his splendid success, inciting others to follow in the same track, has secured to his country a most important branch of internal and foreign commerce, and has placed his name for ever among the worthies of the British nation.

He perceived that the defects of the delft ware, at that time the only species of pottery employed for common domestic purposes, were the softness and looseness of texture of its body, which obliged the potter to make it thick, and clumsy, and heavy, in order to ensure to it a moderate durability; and that its porousness, as well as its dirty gray colour, required a thick coating of white enamel, which added still farther to its bulk and weight, and which, consisting for the most part of lead and arsenic, was hardly safe for culinary use.

He began, therefore, by inventing a body for earthenware, which, at the same time should be white, and capable of enduring a very high degree of heat without fusion, well knowing that the hardness of the

ware depended on the high firing to which it has been subjected. For this purpose, rejecting the common clays of his neighbourhood, he sent as far as Dorsetshire and Devonshire for the whiter and purer pipe-clays of those counties. For the silicious ingredient of his composition, he made choice of chalk flints, calcined and ground to powder.

It might be supposed that white sand would have answered his purpose equally well, and have been cheaper; but, being determined to give the body of his ware as great a degree of compactness as possible, it was necessary that the materials should be reduced to the state almost of an impalpable powder; and calcined flints are much more easily brought to this state by grinding, than sand would be. The perfect and equable mixture of these two ingredients being a point of great importance, he did not choose to trust to the ordinary mode of treading them together when moist, but having ground them between stones, separately, with water, to the consistence of cream, he mixed them together in this state by measure, and then evaporating the superfluous water by boiling in large cisterns, he obtained a composition of the most perfect uniformity in every part. By the combination of these ingredients in different proportions, and exposed to different degrees of heat, he obtained all the variety of texture required, from the bibulous ware employed for glazed articles, such as common plates and dishes, to the compact ware not requiring glazing, of which he made mortars and other similar articles. The almost infusible nature of the body allowed him also to employ a thinner and less fusible glaze, that is, one in which no more lead entered than in common flint glass, and therefore incapable of being affected by any articles of food contained or prepared in such vessels. With these materials, either in their natural white, or variously coloured—black by manganese, blue by cobalt, brown and buff by iron—he produced imitations of the Etruscan vases, and of various other works of ancient art, such as the world had never before seen—such as no subsequent artist has ever attempted to rival. His copies of the Portland vase, of which the liberality of Mr. Pellatt enables me to lay before you a faultless specimen, are miracles of skill; and the other specimens of similar works, for the exhibition of most of which you are indebted to Mr. Josiah Wedgewood, his son and successor, may give some idea of the many beautiful works that were produced in his manufactory.

In table ware for many years he led the way almost without a rival; but the immense demand occasioned by the successive improvements of this article, which first put down the use of delft, and then of pewter, gave ample room and encouragement to men of capital and skill to enter the field of profit and competition. Much good has hence resulted: many subordinate improvements have been effected, and are almost daily making; and a new variety of ware, called ironstone, has been invented, and so rapidly and judiciously improved, that, in appearance, and in many of its intrinsic properties, it bears a close resemblance to the older and coarser porcelains of China itself.

I shall conclude by a summary account of the manufacture of the

best table ware; for a considerable part of which I am indebted to notes taken by Capt. Bagnold, when visiting a pottery, inferior, perhaps, to none in the country. For the copious and interesting collection of specimens of almost every variety of Staffordshire table ware, we are under great obligation to Mr. Pellatt and Mr. Davenport.

The materials of the Staffordshire ware are calcined flints and clay. The flints are burnt in kilns, and then, while hot, quenched in water, by which they are cracked through their whole substance. After being quenched they are ground in mills with water. The mill is a hollow cylinder of wood bound with hoops, and having a bottom of blocks of chert, a hard, tough, silicious stone: the mill-shaft is perpendicular, and has two horizontal arms passing through it crosswise. Between these arms are laid loose blocks of chert, which are moved round on the bed-stone as the arms revolve, and thus grind the flint with water to the consistence of cream.

The clay from Dorsetshire and Devonshire, is mixed with water, and in this state is passed through fine sieves to separate the grosser particles. The flint and clay are now mixed by measure, and the mud or cream is passed through a sieve in order to render the mixture more complete.

In this state it is called slip, and is now evaporated to a proper consistence in long brick troughs. It is then tempered in a pug mill, which is an iron cylinder placed perpendicularly, in which an arbor or shaft revoles, having several knives projecting from it, the edges of which are somewhat depressed. By the revolution of these the clay is cut or kneaded, and finally is forced by their action through a hole in the bottom of the cylinder, and is now ready for use. Cups, pots, basins, and other round articles, are turned rough on the horizontal potter's wheel, and, when half dried, are again turned in a lathe. They are then fully dried in a stove, and the remaining roughnesses are afterwards removed by friction with coarse paper. Articles that are not round, and the round ones that have embossed designs on their surface, are made of thin sheets of clay rolled out like dough, and then pressed into moulds of plaster of Paris; the moulds being previously dried absorb the superficial moisture of the clay, and thus allow it to part from them without injury. The two or three separate pieces composing the article are then united by means of fluid slip. Spouts and handles of jugs and tea pots are made and united with the body of the vessel in the same way. Small handles, beadings, mouldings, &c. are formed by means of an iron cylinder, having its bottom perforated so as to mould the clay, as it passes through, into the required figure. A piston is inserted into the top of the cylinder, and caused to descend slowly by means of a screw, in consequence of which the clay is continually passing out through the perforation, and is cut off in lengths.

Plates are beaten or rolled out of a lump of clay, and are then laid on a mould turned to the shape of the upper surface of the plate. A rotary motion is given to the mould, and an earthenware tool representing a section of the plate is pressed upon it; thus the plate is made smooth, has a uniform thickness given to it, and it takes a per-

fect cast of the mould. Cups, saucers, and basins, when rough-turned, are dried on the block to prevent them from warping.

The ware being thoroughly dried, is packed into saggars and burnt in the furnace to biscuit. Patterns for flat, or nearly flat surfaces, are put on by printing the pattern from a copper plate with an ink composed of oxide of cobalt, oxide of iron, or other colouring matter, mixed with oil. The impression is taken on soft paper, and is applied to the surface of the biscuit, and slightly rubbed to make the print adhere: the biscuit is then soaked in water till the paper may be stripped off, leaving the print or pattern behind. The ware is then dipped in the glaze, which is a mixture of flint slip and white lead, and the bibulous quality of the biscuit causes a sufficient quantity to adhere: the piece is then dried and again passed into the furnace, which brings out the colours of the pattern, and at the same time vitrifies the glaze.

The finest patterns are applied after the glazing has been completed, by taking the impressions from the copper plate on a flexible strap covered with a strong gelatinous mixture of glue and treakle. This strap is then pressed on the ware, and gives the impression in glue, the colouring powder is then dusted over it, and a sufficient portion adheres to the damp parts to give the pattern, after having been again in the furnace. The more elaborate patterns on earthenware, and all those on porcelain, are finished by pencilling in.

[*Rep. Pat. Inv.*

¶ *London Fires in* 1832.

There were, in the year 1832, two hundred and nine fires, as exhibited in the following table.

Months.	Number of Fires.	Number of fatal Fires.	Number of Lives lost.
January	28	0	0
February	23	0	0
March	19	1	1
April	16	0	0
May	13	1	3
June	9	0	0
July	16	0	0
August	14	0	0
September	15	1	1
October	18	1	1
November	15	0	0
December	23	3	3
Total.	209	7	9

Of this number of buildings attacked by fire, there have been consumed 50
Partly consumed . . . 6
And slightly damaged . . . 153

209

The premises at which the fires happened, were occupied as follows:—

Bakers . .	10
Blacking makers . .	1
Booksellers and stationers .	4
Bookbinders . .	2
Boot and shoemakers .	3
Brass founders . .	2
Brewers . .	2
Brush and broom makers . .	2
Cabinet makers . .	6
Carpenters and box makers .	7
Carvers and gilders . .	2
Chandlers . . .	6
Cheesemongers . .	2
Chemists and druggists . .	3
Coachmakers . .	2
Coal merchants . .	1
Coffee and eating houses .	5
Coopers . . .	1
Distillers . .	1
Dwellings, private . .	50
Dyers . . .	1
Featherbed makers . .	1
Fellmongers . .	1
Fringe and lace dealers . .	2
Glass warehouses . .	3
Greengrocers and fruiterers . .	6
Grocers and tea dealers .	5
Haberdashers and hosiers . .	3
Hatters . .	1
Ironmongers . . .	1
Jewellers . .	2
Lampblack makers . .	1
Leather cutters . .	1
——— hose and bucket makers .	1
Linen drapers . .	1
Machinists . . .	2
Milliners and dress makers .	2
Milkmen . . .	2
Music sellers . .	1
Oil and colour men . .	10
Opticians . . .	1
Pawnbrokers . . .	2

Plumbers, painters, and glaziers	2
Pocket book makers	2
Printers	2
Rag merchants	1
Sack makers	1
Scaleboard makers	1
Shipwrights	1
Silversmiths	1
Soap makers	1
Soda-water makers	1
Stables	2
Straw bonnet makers	2
Sugar makers	1
Summer houses	2
Tailors	3
Timber merchants	2
Tinmen	4
Victuallers, licensed	14
Wadding makers	1
Wine merchants,	3
Total	209

For the last three or four years the number of fires has been gradually decreasing; and not only has the number been diminished, but the extent of the conflagrations has also been, upon an average, much more limited than formerly. During the last year there were not above half a dozen fires of any considerable magnitude.

The number of lives lost, as per foregoing statement, is nine; but the total number of persons burnt to death, from the accidental ignition of wearing apparel, &c. is much greater.

After encountering considerable difficulties, arising from various causes, the Lambeth Water company have at length completed a capacious reservoir on Brixton Hill, upwards of one hundred and eighty feet above the level of high water mark, a supply from which, in case of fire, will be available all over the Lambeth Company's district. The reservoir is supplied from the works in Belvidere road, by a splendid *single-acting* steam engine, (by Messrs Maudsley and Field,) of one hundred and ten horse power. This particular form of engine, however, is in the present case injudiciously employed, and the consequences have been a series of shocks upon the mains, so violent as to occasion continual bursting.

I stated in my last communication on this subject, (Mech. Mag. Jan. 28, 1832,) that some of the insurance companies had formed a kind of league, with a view to the reduction of their individual expenses. During the past year the Sun fire office, one of the parties to the above union, have taken up the matter with great spirit, and led the way in an attempt to alter and amend the fire engine arrangements of the metropolis. Their endeavours have, to a certain extent, been crowned with success, and have produced the formation

of a general "London Fire-engine Establishment," which has been joined by ten insurance companies.

The remaining seven offices refuse to join the brigade (as the establishment is frequently termed,) and continue to work their men and engines on the old plan.

The affairs of the London Fire-engine Establishment are managed by a committee, consisting of a director or secretary from each of the Insurance Companies that have joined it, and who subscribe towards its support in certain agreed proportions. The annual expense of the establishment will be nearly £8,000.

The metropolis has been divided into five districts.

The force consists of eighty men, in the permanent employ of the establishment, a great majority of whom have been selected frem the firemen hitherto employed by the above ten insurance companies, and who have relinquished all other occupations on being appointed to the establishment. Instead of the men being under the distinct officers appointed by each company, and therefore not acting in concert at fires, they are now embodied under the direction of a superintendent, with foremen and engineers under him, and appointed to certain stations, where a portion of them are in constant attendance day and night, prepared to give the most prompt assistance on all occasions of fire.

There is one engineer, two senior, and three junior firemen attached to every engine station in each district, one-third of whom are constantly on duty at the different engine houses, night and day; and the whole force are liable to be called up for attendance at fires, or for any other duty. In general, the attendance will be arranged as follows:—

If a fire happen in district A, the whole of the men and engines of that district will immediately repair to the spot; two-thirds of the men, and one of the engines from each of the districts B and D will also go to the fire, and one-third of the men from each of the districts C and E.

If the fire happen in B, the whole of the men and engines in that district will immediately repair to the fire; one engine from A, another from C; two-thirds of the men from A, C, and E, and one-third of the men from D.

If the fire happen in C, the whole of the men and engines in that district will immediately repair to the fire; one engine and two-thirds of the men from each of the districts B and E, and one-third of the men from A and D, will go to the fire.

If the fire is in E, the whole of the men and engines in that district, with one engine and two-thirds of the men from each of the districts C and D, and one-third of the men from A and B, will go to the fire.

If the fire happen in D, the whole of the men and engines in that district, with one engine and two-thirds of the men from each of the districts A and E, and one-third of the men from B and C, will go to the fire.

If a fire happens on the boundary of a district, and it is doubtful in which district it has occurred, the whole of the engines and men

of the two adjoining districts are instantly to proceed to the spot, and one-third of the men of the three remaining districts.

In case of emergency the superintendent will call in such additional force as he may require.

The engines will be conveyed to fires at no less than seven miles an hour, and the men who do not accompany the engines will go at not less than five miles an hour.

The men are clothed in a dark gray uniform trimmed with red, having their respective numbers in red on the left breast; they have black leather waist-belts, and hardened leather caps or helmets. Their dress is neat and appropriate, and much more conducive to safety and comfort than that formerly worn. The leather caps especially afford a very great protection to the wearers, and it is somewhat strange that they should ever have fallen into disuse, for they were some years back very common. The new caps, however, are better made, more convenient, and much smarter than those formerly used.

Each engine is provided with the following judicious selection of useful articles:—Two lengths of scaling ladder, each eight to nine feet long, all of which may be readily connected, forming in a short space of time, a ladder of any required height; a canvass sheet, with ten or twelve handles of rope round the edge of it. One ten fathom, and one fourteen fathom piece of two and a half inch rope. Six forty feet lengths of hose. Two branch pipes, one two and a half feet, and the other from four to six feet long; with one spare nose piece. Two six feet lengths of suction pipe. A flat rose, standcock, goose-neck, dam-board, boat-hook, saw, shovel, mattock, poleaxe, crow-bar, and two dog-tails. A ball of strips of sheep-skin, a ball of small cord, and instruments for opening plugs, fire-cocks, &c.

The above list shows that the attention of the firemen is especially directed to the saving of human life as well as the rescue of property and the most speedy suppression of fire.

[*Mech. Mag.*

A few remarks on the Relation which subsists between a Machine and its Model. By Edward Sang, *Teacher of Mathematics, Edinburgh. Communicated by the Author.*

At first sight, a well constructed model presents a perfect representation of the disposition and proportion of the parts of a machine, and of their mode of action.

Misled by the alluring appearance, one is apt, without entering minutely into the inquiry, also to suppose that the performance of a model is, in all cases, commensurate with that of the machine which it is formed to represent. Ignorant of the inaccuracy of such an idea, too many of our ablest mechanicians and best workmen waste their time and their abilities on contrivances which, though they perform well on the small scale, must, from their very nature, fail when en-

larged. Were such people acquainted with the mode of computing the effects, or had they a knowledge of natural philosophy, sufficient to enable them to understand the basis on which such calculations are founded, we should see fewer crude and impracticable schemes prematurely thrust upon the attention of the public. This knowledge, however, they are too apt to regard as unimportant, or as difficult of attainment. They are startled by the absurd distinction which has been drawn between theory and practice, as if theory were other than a digest of the results of experience; or, if they overcome this prejudice, and resolve to dive into the arcana of philosophy, they are bewildered among names and signs, having begun the subject at the wrong end. That the attainment of such knowledge is attended with difficulty is certain, but it is with such difficulty only as can be overcome by properly directed application. It would be, indeed, preparing disappointment to buoy them up with the idea, that knowledge, even of the most trivial importance, can be acquired without labour. Yet it may not be altogether unuseful, for the sake both of those who are already, and of those who are not, acquainted with these principles, to point out the more prominent causes, on account of which the performance of no model can, on any occasion, be considered as representative of that of the machine. Such a notice will have the effect of directing the attention, at least, to this important subject. In the present state of the arts, the expense of constructing a full-sized instrument is, in almost every instance, beyond what its projector would feel inclined, or even be able, to incur. The formation of a model is thus universally resorted to, as a prelude to the attempt on the large scale. An inquiry, then, into the relation which a model bears to the perfect instrument, can hardly fail to carry along with it the advantage of forming a tolerable guide, in estimating the real benefit which a contrivance is likely to confer upon society.

In the following paper I propose to examine the effect of a change of scale on the strength and on the friction of machines, and, at the same time, to point out that adherence to the strictest principles which is apparent in all the works of nature, and of which I mean to avail myself in fortifying my argument.

Previous, however, to entering on the subject-proper, it must be remarked that, when we enlarge the scale according to which any instrument is constructed, its surface and its bulk are enlarged in much higher ratios. If, for example, the linear dimensions of an instrument be all doubled, its surface will be increased four, and its solidity eight, fold. Were the linear dimensions increased ten times, the superfices would be enlarged one hundred, and the solidity one thousand, times. On these facts, the most important which geometry presents, my after remarks are mostly to be founded.

All machines consist of moveable parts, sliding or turning on others, which are bound together by bands, or supported by props. To the frame work I shall first direct my attention.

In the case of a simple prop, destined to sustain the mere weight of some part of the machine, the strength is estimated at so many hundred weights per square inch of cross section. Suppose that, in the

model, the strength of the prop is sufficient for double the load put on it, and let us examine the effect of an enlargement, ten fold, of the scale according to which the instrument is constructed. By such an enlargement, the strength of the prop would be augmented 100 times; it would be able to bear 200 loads such as that of the model, but then the weight to be put on it would be 1000 times that of the small machine, so that the prop in the large machine would be able to bear only the fifth part of the load to be put on it. The machine, then, would fall to pieces by its own weight.

Here we have one example of the erroneous manner in which a model represents the performance of a large instrument. The supports of small objects ought clearly to be smaller in proportion than the supports of large ones. Architects, to be sure, are accustomed to enlarge and to reduce in proportion; but nature, whose structures possess infinitely more symmetry, beauty, and variety, than those of which art can boast, is content to change her proportions at each change of size. Let us conceive an animal having the proportions of an elephant and only the size of a mouse; not only would the limbs of such an animal be too strong for it, they would also be so unwieldy that it would have no chance among the more nimble and better proportioned creatures of that size. Reverse the process, and enlarge the mouse to the size of an elephant, and its limbs, totally unable to sustain the weight of its immense body, would scarcely have strength to disturb its position even when recumbent.

The very same remarks apply to that case in which the weight, instead of compressing, distends the support. The chains of Trinity Pier are computed to be able to bear nine times the load put on them. But if a similar structure were formed of ten times the linear dimensions, the strength of the new chain would be one hundred times the strength of that at Trinity, while the load put upon it would be one thousand times greater; so that the new structure would possess only nine-tenths of the strength necessary to support itself. Of how little importance, then, in bridge building, whether a model constructed on a scale of perhaps one to a hundred support its own weight! Yet, on such grounds, a proposition for throwing a bridge of two arches across the Forth, at Queensferry, was founded. Putting out of view the roadway and passengers altogether, the weight of the chain alone would have torn it to pieces. The larger species of spiders spin threads much thicker, in comparison with the thickness of their own bodies, than those spun by the smaller ones. And, as if sensible that the whole energies of their systems would be expended in the frequent reproduction of such massy webs, they choose the most secluded spots; while the smaller species, dreading no inconvenience from a frequent renewal of theirs, stretch them from branch to branch, and often from tree to tree. I have often been astonished at the prodigious lengths of these filaments, and have mused on the immense improvement which must take place in science, and in the strength of materials too, ere we could, individually undertake works of such comparative magnitude.

When a beam gives support laterally, its strength is proportioned

to its breadth, and to the square of its depth conjointly. If, then, such a beam were enlarged ten times in each of its linear dimensions, its ability to sustain a weight placed at its extremity would, on account of the increased distance from the point of insertion, be only one hundred times augmented, but the load to be put upon it would be one thousand times greater; and thus, although the parts of the model be quite strong enough, we cannot thence conclude that those of the enlarged machine will be so.

It may thus be stated as a general principle, that, in similar machines, the strengths of the parts vary as the square, while the weights laid on them vary as the cube of the corresponding linear dimension.

This fact cannot be too firmly fixed in the minds of machine makers; it ought to be taken into consideration even on the smallest change of scale, as it will always conduce either to the sufficiency or to the economy of a structure. To enlarge or diminish the parts of a machine all in the same proportion, is to commit a deliberate blunder. Let us compare the wing of an insect with that of a bird: enlarge a midge till its whole weight be equal to that of the sea-eagle, and, great as that enlargement must be, its wing will scarcely have attained the thickness of writing paper;—the falcon would feel rather awkward with wings of such tenuity. The wings of a bird, even when idle, form a conspicuous part of the whole animal; but there are insects which unfold, from beneath two scarcely perceived covers, wings many times more extensive than the whole surface of their bodies.

The larger animals are never supported laterally; their limbs are always in a position nearly vertical: as we descend in the scale of size the lateral support becomes more frequent, till we find whole tribes of insects resting on limbs laid almost horizontally. The slightest consideration will convince any one that lateral or horizontal limbs would be quite inadequate to support the weight of the larger animals. Conceive a spider to increase till his body weighed as much as that of a man, and then fancy one of us exhibiting feats of dexterity with such locomotive instruments as the spider would then possess!

The objects which I have hitherto compared have been remote, that the comparisons might be the more striking; but the same principles may be exhibited by the contrast of species the most nearly allied, or of individuals even of the same species. The larger species of spiders, for instance, rarely have their legs so much extended as the smaller ones; or, to take an example, from the larger animals, the form of the Shetland poney is very different from that of the London dray horse.

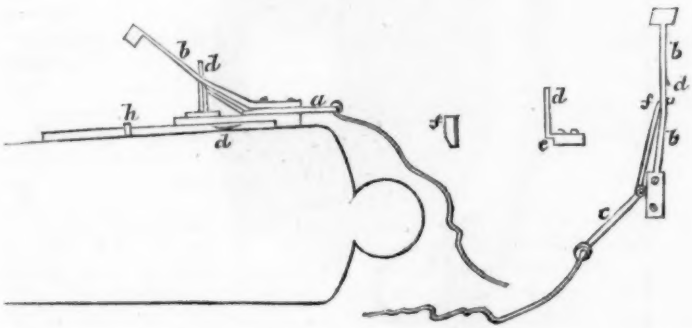
How interesting it is to compare the different animals, and to trace the gradual change of form which accompanies each increase of size! In the smaller animals, the strength is, as it were, redundant, and there is room for the display of the most elaborate ornament. How complex or how beautiful are the myriads of insects which float in the air, or which cluster on the foliage! Gradually the larger of these become more simple in their structure, their ornaments less profuse. The structure of the birds is simpler and more uniform, that of the

quadrupeds still more so. As we approach the larger quadrupeds, ornament, and then elegance disappear. This is the law in the works of nature, and this ought to be the law among the works of art.

Among one class of animals, indeed, it may be said that this law is reversed. We have by no means a general classification of the fishes; but, among those with which we are acquainted, we do not percieve such a prodigious change of form. Here, however, the animal has not to support its own weight; and whatever increase may take place in the size of the animal, a like increase takes place in the buoyancy of the fluid in which it swims. Many of the smaller aquatic animals exhibit the utmost simplicity of structure; but we know too little of the nature of their functions to draw any useful conclusions from this fact.

[TO BE CONTINUED.]

¶ *French Percussion Gun Lock.*



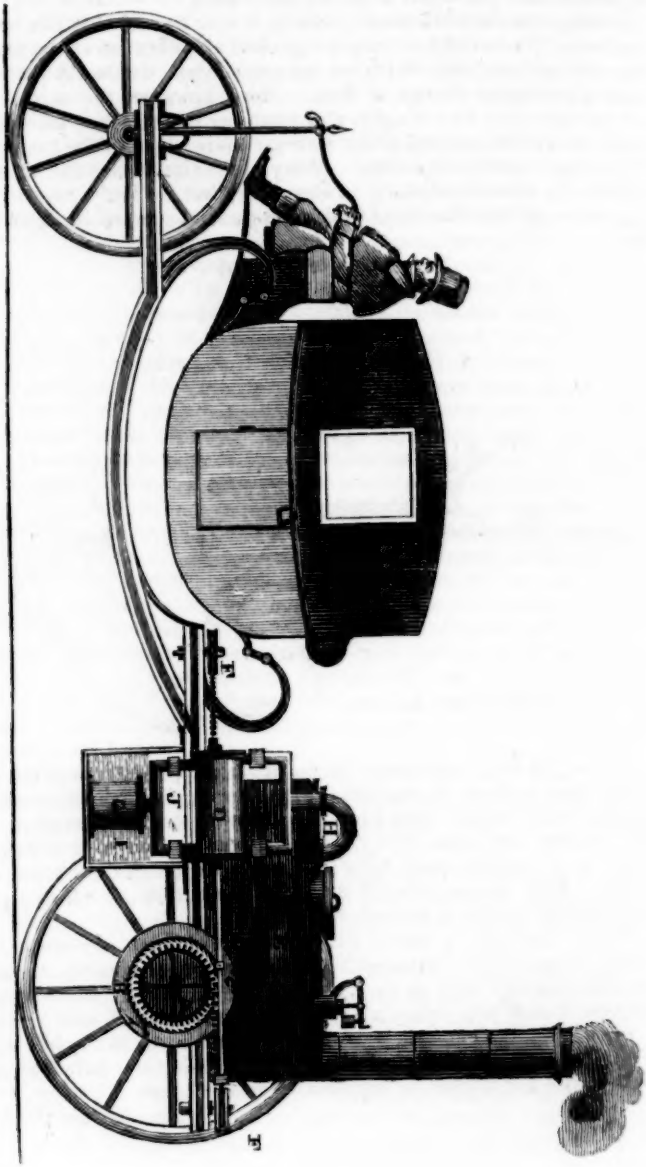
SIR,—The lock represented in the above drawings, fixes to the gun in the usual manner by *one* nut at *a*; the spring and hammer are both in one, *b*; the trigger *c* has its upper part sloped a little, as shown in the separate front view of it, *f*, by which means the spring is detained so as to require some force to liberate it; the guide *d* bears the spring a little on one side till it reaches the bottom, at which a part is filed away as at *e* in the side view.

When the trigger is pulled with the requisite force, the spring descends along the side of the guide *d*, the hammer strikes the cap at *h*, and immediately slips to the right into the notch *e*, by which means the vent is instantly comeatable to be stopped, pricked, and primed.

In cocking, the hammer is laid hold of and borne to the left sufficiently to clear the spring of the notch *e*; it is then lifted up and locked with the trigger, as represented in the figure.

[*Mech. Mag.*

¶ *Mr. Symington's Steam Carriage Experiments.* 1784–86.



Sir,—The drawing now sent, represents the model of a steam carriage, which was invented by my father in 1784, and was exhibited by him to the Professors of the University, and other scientific gentlemen in Edinburgh, in 1786.

The opinion entertained of the practicability of the invention was so favourable, that my father was warmly urged to bring his experiments into practice; and the late Gilbert Meason, Esq., who always proved his patron, liberally offered to defray any expenses which might be incurred.

The state of the roads, and the difficulty which at that time would have existed of procuring water and fuel, afforded sufficient reasons to induce my father to abandon an attempt, which, through these causes, he believed, would only have produced disappointment to his kind advisers.

Whilst engaged with this model, the idea occurred to him, that upon the same principles vessels might be propelled on water by the power of steam; an idea, the correctness of which was fully proved by the exemplification afforded in 1788, on Dalswinton Lake, of which exemplification a sketch will be furnished as soon as time will permit.

Feeling obliged by your prompt attention to my former communication,

I remain, sir,
Your most obedient servant,

Bromley, Sept. 24. Wm. Symington.

Description of the Engraving.

A, the drum, fixed upon the hind axle. B, tooth and ratchet wheels; C, rack-rods, one on each side of the drum, the alternate action of which, upon the tooth and ratchet wheels, produces the rotary motion. D, cylinder. E, boiler, supplied from condensor. FF, direction-pulleys. G, condensor. H, steam-pipe. I, water-tank. J, eduction pipe.

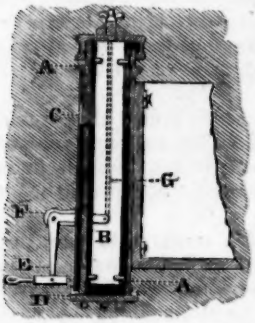
A material advantage obtained by the mode here employed, of applying the power of the engine, is its always acting at a right angle upon the axle of the carriage.

[*Mech. Mag.*

¶ *Milne's Mercurial Dynamometer.*

Practical engineers complain that those dynamometers which indicate the quantum of force applied by a horse upon a rail-way, by the inflexion of springs, lose their elasticity when kept at work for any considerable time; the oscillations of the index-pointer, too, make it impossible to ascertain the medium of unequal draught applied by the animal in stepping out. Such also is the case when any other common instrument is used for this purpose. Both of these defects are completely obviated by the mercurial dynamometer now to

be described. This instrument consists of a hollow metallic cylinder, A, in which is placed a floating piston, B, which should be about one-tenth of an inch less in diameter than the cylinder, in which it must move freely up or down. To prevent friction, four small rollers should be inserted into the side of this wooden float both at its top and bottom; which rollers should not project further than to admit of the piston being "shake free" within its cylinder. In order, also, to prevent absorption of the mercury, the wood should be coated with bees' wax mixed with whiteing or with lampblack. These things being attended to, and a portion of mercury placed within the cylinder, by pushing down the piston, the fluid will ascend in a thin film between it and the cylinder, till the statical weight of the mercury, acting on the base of the floating piston, balances the force exerted in pushing it down. Hence, since the statical weight of the fluid increases reciprocally as the height to which it is caused to ascend by its displacing force, so must its various points of height within the cylinder be a measure of the force in equilibrio with the statical weight of the fluid.



Such being the construction of this dynamometer, it is only necessary to fix it in a vertical position to the front of the foremost of a train of waggons, and to turn the direction of the horses' draught in such a manner as to cause it to pull down the floating piston; while a glass tube exhibits the height of the fluid, and consequently the force exerted by the animal. To prevent any sudden elevations or depressions in the mercury in the tube, from the irregularity of the horse's draught, the socket in which it is placed has a ventricle, at D, the diameter of which is .033 of an inch, while that of the glass tube is .250; wherefore $\frac{.250^2}{.033^2} = 57.4$; hence the elevation or depression of the mercury in the tube must be 57.4 times less than in the cylinder; the celerity of which fluid, too, is still further reduced by springs attached to the draught-hook. Since this machine was first constructed, it has occurred to Mr. Milne, that by attaching a stop-cock, the celerity of the motion of the mercury in the glass tube could be regulated to any required extent with the utmost exactness. In addition to these contrivances, oscillations of the fluid might be still further prevented by making the yoke levers, E, shorter than those which pull down the piston. The friction of the arbor, F, might also be much lessened by making its extremities similar to the bearing pivots of a common balance.

Mr. Granger, the engineer, having placed this dynamometer on a carriage so constructed that neither the weight of the instrument nor of the persons upon it should affect the results, made a number of very interesting and useful experiments with it on the Kirkintilloch

rail-way. The first object in these experiments was to ascertain the capabilities of the dynamometer; on which head nothing can be more satisfactory than the testimony Mr. G. has given. "It is altogether superior, he says, "to any other I have seen; and it is the opinion of several engineers who have seen it at work that it is the best instrument for engineering purposes that has ever been tried. A long and circumstantial narrative of these experiments is given, but it is only necessary that we should here place before our readers the principal facts which they have established with respect to friction on rail-ways.

1. The medium friction of a train of five wagons on a level part of the rail-way was nine pounds per ton; while on a curved part, with a radius of about 800 feet, it was eighteen pounds per ton.

2. A draught of 10.8 lbs. per ton was required to travel at the rate of three miles an hour when the rails were dry, and only 6.8 lbs. when wet.

3. On a level, the force exerted by a horse was observed to vary from 90 to 100 lbs., but when the train came to a part of the rail-way which inclined at the rate of 1 in 280, the wagons descended freely by their own gravity.

4. On a descent of 1 in 117, a wagon with wheels 2.5 feet in diameter carried 1020 lbs. more weight than one with three feet wheels, at the same rate of speed, and with the same power applied; but on a curve with a radius of 1000 feet the three feet wheels proved superior to the 2.5—a circumstance which Mr. Mylne ascribes to the axles of the three feet wheels being of two pieces, meeting within a bush at the centre, while the 2.5 wheels were attached by an inflexible axle, whence it followed, in the case of the former, that "all the wheels would roll upon the rails of different radii, independent of the motions of each other."

5. The average force of draught required on a level at 3.5 miles per hour was eight pounds per ton; at 6.66 miles, 9.5 lbs.; at 7.5 miles, 10.2 lbs.; at eight miles, 10.67 lbs.; at 8.57 miles, 11.63 lbs.

[*Mech. Mag.*

Tincture of Roses.

Take the leaves of the common rose (*centifoliæ,*) place them without pressing them in a bottle, pour some good spirits of wine upon them, and let it stand until it is required for use. This tincture will keep for years, and yield a perfume little inferior to attar of roses: a few drops of it will suffice to impregnate the atmosphere of a room with a delicious odour. Common vinegar is greatly improved by a very small quantity being added to it.

[*Reg. of Arts.*

¶ Popular Science.

No. IV.

Selections from Letters on Natural Magic.
By Sir David Brewster.

(Continued from p. 288.)

Acoustic Mechanism—Automata.

Many very ingenious pieces of acoustic mechanism have been from time to time exhibited in Europe. The celebrated Swiss mechanist M. Le Droz constructed for the king of Spain the figure of a sheep, which imitated in the most perfect manner the bleating of that animal; and likewise the figure of a dog watching a basket of fruit, which, when any of the fruit was taken away, never ceased barking till it was replaced.

The singing bird of M. Maillardet, which he exhibited in Edinburgh many years ago, is still more wonderful.* An oval box, about three inches long, was set upon the table, and in an instant the lid flew up, and a bird of the size of the humming-bird, and of the most beautiful plumage, started from its nest. After fluttering its wings, it opened its bill and performed four different kinds of the most beautiful warbling. It then darted down into its nest, and the lid closed upon it. The moving power in this piece of mechanism is said to have been springs, which continued their action only four minutes. As there was no room within so small a figure for accommodating pipes to produce the great variety of notes which were warbled, the artist used only one tube, and produced all the variety of sounds by shortening and lengthening it with a moveable piston.

Ingenious as these pieces of mechanism are, they sink into insignificance when compared with the machinery of M. Vaucanson, which had previously astonished all Europe. His two principal automata were the flute player, and the pipe and tabor player. The flute player was completed in 1736, and wherever it was exhibited it produced the greatest sensation. When it came to Paris it was received with great suspicion. The French scavans recollected the story of M. Raisin, the organist of Troyes, who exhibited an automaton player upon the harpsichord, which astonished the French court by the variety of its powers. The curiosity of the king could not be restrained, and in consequence of his insisting upon examining the mechanism, there was found in the figure a pretty little musician five years of age. It was natural, therefore, that a similar piece of mechanism should be received with some distrust; but this feeling was soon removed by M. Vaucanson, who exhibited and explained to a committee of the Academy of Sciences the whole of the mechanism. This learned body was astonished at the ingenuity which it displayed; and

* A similar piece of mechanism had been previously made by M. le Droz.

they did not hesitate to state, that the machinery employed for producing the sounds of the flute performed in the most exact manner the very operations of the most expert flute player, and that the artist had imitated the effects produced and the means employed by nature, with an accuracy which exceeded all expectation. In 1738 M. Vaucanson published a memoir, approved of by the Academy, in which he gave a full description of the machinery employed, and of the principles of its construction. Following this memoir, I shall therefore attempt to give as popular a description of the automaton as can be done without lengthened details and numerous figures.

The body of the flute player was about five and a half feet high, and was placed upon a piece of rock, surrounding a square pedestal four and a half feet high by three and a half wide. When the panel which formed the front of the pedestal was opened, there was seen on the right a clock movement, which, by the aid of several wheels, gave a rotatory motion to a steel axis about two and a half feet long, having cranks at six equidistant points of its length, but lying in different directions. To each crank was attached a cord, which descended, and was fixed by its other end to the upper board of a pair of bellows, two and a half feet long and six inches wide. Six pair of bellows arranged along the bottom of the pedestal were then wrought or made to blow in succession, by turning the steel axis.

At the upper face of the pedestal, and upon each pair of bellows, is a double pulley, one of whose rims is three inches in diameter, and the other one and a half. The cord which proceeds from the crank coils round the smallest of these pulleys, and that which is fixed to the upper board of the bellows goes round the larger pulley. By this means the upper board of the bellows is made to rise higher than if the cords went directly from them to the cranks.

Round the larger rims of three of these pulleys, viz. those on the right hand, there are coiled three cords, which, by means of several smaller pulleys, terminate in the upper boards of other three pair of bellows placed on the top of the box.

The tension of each cord when it began to raise the board of the bellows to which it is attached gives motion to a lever placed above it between the axis and the double pulley in the middle and lower region of the box. The other end of this lever keeps open the valve in the lower board of the bellows, and allows the air to enter freely, while the upper board is rising to increase the capacity of the bellows. By this means there is not only power gained, in so far as the air gains easier admission through the valve, but the fluttering noise produced by the action of the air upon the valves, is entirely avoided, and the nine pair of bellows are wrought with great ease, and without any concussion or noise.

These nine bellows discharge their wind into three different and separate tubes. Each tube receives the wind of three bellows, the upper boards of one of the three pair being loaded with a weight of four pounds, those of the second three pair with a weight of two pounds, and those of the other three pair with no weight at all. These three tubes ascended through the body of the figure, and terminated in three

small reservoirs placed in its trunk. These reservoirs were thus united into one, which, ascending into the throat, formed by its enlargement the cavity of the mouth terminated by two small lips, which rested upon the hole of the flute. These lips had the power of opening more or less, and by a particular mechanism they could advance or recede from the hole in the flute. Within the cavity of the mouth there is a small moveable tongue for opening and shutting the passage for the wind through the lips of the figure.

The motions of the fingers, lips, and tongue of the figure were produced by means of a revolving cylinder thirty inches long and twenty one in diameter. By means of pegs and brass staples fixed in fifteen different divisions in its circumference, fifteen different levers, similar to those in a barrel organ, were raised and depressed. Seven of these regulated the motions of the seven fingers for stopping the holes of the flute, which they did by means of steel chains rising through the body and directed by pulleys to the shoulder, elbow, and fingers. Other three of the levers communicating with the valves of the three reservoirs regulated the ingress of the air, so as to produce a stronger or a weaker tone. Another lever opened the lips so as to give a free passage to the air, and another contracted them for the opposite purpose. A third lever drew them backwards from the orifice of the flute, and a fourth pushed them forward. The remaining lever enabled the tongue to stop up the orifice of the flute.

Such is a very brief view of the general mechanism by which the requisite motions of the flute player were produced. The airs which it played were probably equal to those executed by a living performer, and its construction, as well as its performances, continued for many years to delight and astonish the philosophers and musicians of Europe.

Encouraged by the success of this machine, M. Vaucanson exhibited in 1741 other automata, which were equally, if not more, admired. One of these was the automaton duck, which performed all the motions of that animal, and not only ate its food, but digested it; and the other was his pipe and tabor player, a piece of mechanism which required all the resources of his fertile genius. Having begun this machine before he was aware of its peculiar difficulties, he was often about to abandon it in despair, but his patience and his ingenuity combined enabled him, not only to surmount every difficulty, but to construct an automaton which performed complete airs, and greatly excelled the most esteemed performers on the pipe and tabor.

The figure stands on a pedestal, and is dressed like a dancing shepherd. He holds in one hand a flageolet, and in the other a stick with which he beats the tambourin as an accompaniment to the airs of the flageolet, about twenty of which it is capable of performing. The flageolet has only three holes, and the variety of its tones depends principally on a proper variation of the force of the wind, and on the different degrees with which the orifices are covered. These variations in the force of the wind required to be given with a rapidity which the ear can scarcely follow, and the articulation of the tongue was required for the quickest notes, otherwise the effect was

far from agreeable. As the human tongue is not capable of giving the requisite articulations to a rapid succession of notes, and generally slurs over one-half of them, the automaton was thus able to excel the best performers, as it played complete airs with articulations of the tongue at every note.

In constructing this machine M. Vaucanson observed that the flageolet must be a most fatiguing instrument for the human lungs, as the muscles of the chest must make an effort equal to fifty-six pounds in order to produce the highest notes. A single ounce was sufficient for the lowest notes; so that we may, from this circumstance, form an idea of the variety of intermediate effects required to be produced.

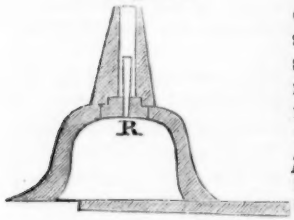
While M. Vaucanson was engaged in the construction of these wonderful machines, his mind was filled with the strange idea of constructing an automaton containing the whole mechanism of the circulation of the blood. From some birds which he made he was satisfied of its practicability; but as the whole vascular system required to be made of elastic gum, or caoutchouc, it was supposed that it could only be executed in the country where the caoutchouc tree was indigenous. Louis XVI. took a deep interest in the execution of this machine. It was agreed that a skilful anatomist should proceed to Guyana, to superintend the construction of the blood-vessels, and the king had not only approved of, but had given orders for, the voyage. Difficulties, however, were thrown in the way: Vaucanson became disgusted, and the scheme was abandoned.

The two automata which we have described were purchased by Professor Bayreuss of Helmstadt, but we have not been able to learn whether or not they still exist.

Towards the end of the seventeenth century, a bold and almost successful attempt was made to construct a *talking automaton.* In the year 1779, the Imperial Academy of Sciences at St. Petersburg proposed as the subject of one of their annual prizes an inquiry into the nature of the vowel sounds, A, E, I, O, U, and the construction of an instrument for artificially imitating them. This prize was gained by M. Kratzenstein, who showed that all the vowels could be distinctly pronounced by blowing through a reed into pipes of different figures.

About the same time that Kratzenstein was engaged in these researches, M. Kempelen of Vienna, a celebrated mechanician, was occupied with the same subject. In his first attempt he produced the vowel sounds by adapting a reed R, fig. 48, to the bottom of a funnel-shaped cavity AB, and placing his hand in various positions within the funnel. This contrivance, however, was not fitted for his purpose; but after long study, and a diligent examination of the organs of speech, he contrived a hollow oval box, divided into portions attached by a hinge so as to resemble jaws. This box received the sound which issued from the tube connected with the reed, and by opening and closing the jaws he produced the sounds A, O, OU, and an imperfect E, but no indications of an I. After two years' labour he succeeded in obtaining from different jaws the sound of the

Fig. 48.



consonants P, M, L, and by means of these vowels and consonants he could compose syllables and words, such as *mamma*, *papa*, *aula*, *lama*, *mulo*. The sounds of two adjacent letters, however, ran into each other, and an aspiration followed some of the consonants, so that instead of *papa* the word sounded *phaaph a;* these difficulties he contrived with much labour to surmount, and he found it necessary to imitate the human organs of speech by having only one mouth and one glottis. The mouth consisted of a funnel, or bell-shaped piece of elastic gum, which approximated by its physical properties to the softness and flexibility of the human organs. To the mouth-piece was added a nose made of two tin tubes, which communicated with the mouth. When both these tubes were open, and the mouth-piece closed, a perfect M was produced, and when one was closed and the other open, an N was sounded. M. Kempelen could have succeeded in obtaining the four letters D, G, K, T, but by using a P instead of them, and modifying the sound in a particular manner, he contrived to deceive the ear by a tolerable resemblance of these letters.

There seems to be no doubt that he at last was able to produce entire words and sentences, such as *opera*, *astronomy*, *Constantinopolis*, *vous etés mon ami*, *je vous aime de tout mon cœur*, *venez avec moi à Paris*, *Leopoldus secundus*, *Romanorum imperator semper Augustus*, &c.; but he never fitted up a speaking figure, and probably from being dissatisfied with the general result of his labours, he exhibited only to his private friends the effects of the apparatus, which was fitted up in the form of a box.

This box was rectangular, and about three feet long, and was placed upon a table, and covered with a cloth. When any particular word was mentioned by the company, M. Kempelen caused the machine to pronounce it, by introducing his hands beneath the cloth, and apparently giving motion to some parts of the apparatus. Mr. Thomas Collinson, who had seen this machine in London, mentions in a letter to Dr. Hutton, that he afterwards saw it at M. Kempelen's own house in Vienna, and that he then gave it the same word to be pronounced which he gave it in London, viz. the word *Exploitation*, which, he assures us, it again distinctly pronounced, with the French accent.

M. Kratzenstein seems to have been equally unsuccessful, for though he assured M. De Lalande, when he saw him in Paris in 1786, that he had made a machine which could speak pretty well, and though he showed him some of the apparatus by which it could sound the vowels, and even such syllables as *papa* and *mamma*, yet there is no reason to believe that he had accomplished more than this.

The labours of Kratzenstein and Kempelen have been recently pursued with great success by our ingenious countryman Mr. Willis, of Cambridge. In repeating Kempelen's experiment, shown in fig.

48, he used a shallower cavity, and found that he could entirely dispense with the introduction of the hand, and could obtain the whole series of vowels, by sliding a flat board over the mouth of the cavity. Mr. Willis then conceived the idea of adapting to the reed cylindrical tubes, whose length could be varied by sliding joints. When the tube was greatly less than the length of a stopped pipe in unison with the reed, it sounded I, and by increasing the length of the tube it gave E, A, O, and U, in succession. But, what was very unexpected, when the tube was so much lengthened as to be one and a half times the length of a stopped pipe in unison with the reed, the vowels began to be again sounded in an inverted order, viz. U, O, A, E, and then again in a direct order, I, E, A, O, U, when the length of the tube was equal to twice that of a stopped pipe in unison with the reed.

Some important discoveries have been recently made by M. Savart respecting the mechanism of the human voice,* and we have no doubt that before another century is completed a talking and a singing machine will be numbered among the conquests of science.

Watt's Machine for Copying Busts.

One of the most curious and important applications of machinery to the arts which has been suggested in modern times was made by the late Mr. Watt, in the construction of a machine for copying or reducing statues and sculpture of all kinds. The art of multiplying busts and statues, by casts in plaster of Paris, has been the means of diffusing a knowledge of this branch of the fine arts; but from the fragile nature of the material, the copies thus produced were unfit for exposure to the weather, and therefore ill calculated for ornamenting public buildings, or for perpetuating the memory of public achievements. A machine, therefore, which is capable of multiplying the labours of the sculptor in the durable materials of marble or of brass, was a desideratum of the highest value, and one which could have been expected only from a genius of the first order. During many years, Mr. Watt carried on his labours in secret, and he concealed even his intention of constructing such a machine. After he had made considerable progress in its execution, and had thought of securing his invention by a patent, he learned that an ingenious individual in his own neighbourhood had been long occupied in the same pursuit; and Mr. Watt informed me that he had every reason to believe that this gentleman was entirely ignorant of his labours. A proposal was then made that the two inventors should combine their talents, and secure their privilege by a joint patent; but Mr. Watt had experienced so frequently the fatal operation of our patent laws, that he saw many difficulties in the way of such an arrangement, and he was unwilling at his advanced age, to embark in a project so extensive, and which seemed to require for its successful prosecution all the ardour and ambition of a youthful mind.

[TO BE CONTINUED.]

* See Edinburgh Journal of Science, No. viii. p. 200.

Notice to Correspondents.

Mr. J. L. Jennison, and Mr. J. L. Sullivan, will receive due attention in our July number. Those who think themselves in any way aggrieved by any thing which appears in our pages, shall always be heard through the same medium, however forcibly they may complain, provided always that due decorum is observed.

Meteorological Observations for March, 1833.

Moon.	Days.	Therm. Sun rise.	Therm. 2 P. M.	Barometer. Sun rise.	Barometer. 2 P. M.	Dew point	Wind. Direction.	Wind. Force.	Water fallen in rain.	State of the weather, and Remarks.
				Inches.	Inches.				Inches.	
☉	1	19°	34°	29.90	29.75	15°	NE.	Blustering.	0.32	Snow.
	2	15	30	.83	.80	−5	NE.	do.		Clear—drifting.
	3	3	26	30.10	.80	+1	W.	do.		Clear—cloudy.
	4	20	30	29.83	.00	−2	W.	do.		Clear day.
	5	17	37	30.26	.20		W. W.	Moderate.		Clear—cloudy—snow in night.
	6	19	30	29.70	29.73	+13	W. W.	do.	0.31	Snow—flying clouds.
	7	15	37	30.00	.90	18	W. SW.	do.		Light clouds—flying clouds.
	8	24	45	29.70	.60	24	E. SE.	do.		Cloudy day.
	9	29	40	.60	.60	23	N. W.	do.		Scattering clouds—clear.
	10	30	35	.76	.80	27	WSW. SE.	do.		Cloudy—light clouds.
	11	28	42	30.00	30.10	33	NW. SE.	do.		Clear day.
	12	29	37	29.90	29.90	28	E.	do.		Cloudy—rain.
☾	13	31	40	.80	.82	20	NW.	do.	0.45	Clear day.
	14	20	45	30.00	30.10	14	N. E. S.	do.		Clear day.
	15	31	44	.00	.00	18	S. E.	do.		Cloudy—clear.
	16	30	46	.20	.20	23	N. E. SE.	do.		Clear day.
	17	26	43	.30	.30	22	SE. W.	Calm.		Cloudy—clear—rain in night.
	18	32	52	.10	29.94	42	W.	do.	0.70	Rain—cloudy.
	19	39	64	29.94	29.80	54	S.	do.	0.02	Cloudy day.
	20	51	59	.60	.70	59	W.	Blustering.		Flying clouds—cloudy.
	21	56	64	.64	.60	57	S.	do.		Clear day.
	22	49	57	.50	.50	57½	W.	Moderate.		Foggy—lightly cloudy.
	23	38	56	.80	.80	39	NW. S.	do.		Cloudy—clear.
	24	36	62	.80	.70	38	SW.	do.		Clear day.
	25	42	54	.80	.50	37	N. W. W.	Blustering.		Clear—lightly cloudy.
☽	26	32	45	.64	.66	30	N. W. W.	Moderate.		Clear—cloudy.
	27	27	43	.90	.90	20	N. W. W.	do.		Cloudy day.
	28	25	42	.95	.90	11	N.	do.		Clear day.
	29	26	44	.74	.70	11	N. W.	Blustering		
	30	30	48	.84	.99	15	W. N. W.	Moderate.		
	31	33	49	30.09	.93	24	W.			
	Mean	29.10	43.39	29.86	29.86	24.6			1.80	

		Thermometer.	Barometer.
Maximum height during the month,		64. on 19th & 21st.	30.30 on 17th.
Minimum	do.	3. on 3d.	29.50 on 22nd & 25th.
Mean	do.	36.24	29.86